PAGE'S WEEKLY.—March 17, 1905. Thin Paper Copy for Circulation Abroad.

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SITY OF TORO

PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

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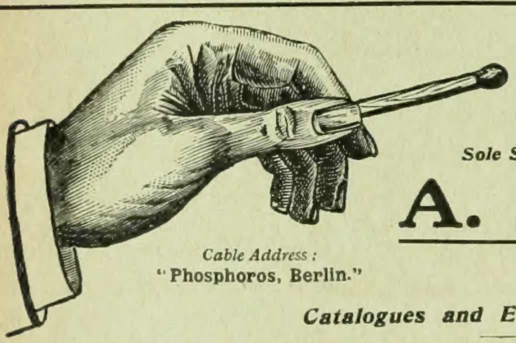

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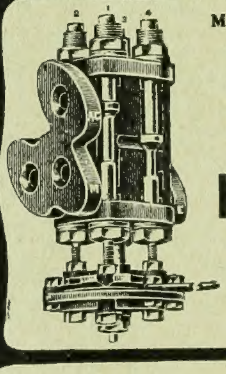

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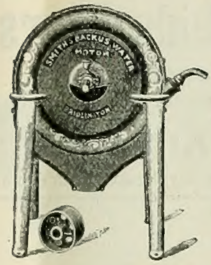

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JOSEPH BOOTH BROS., LTD., RODLEY, LEEDS. See next week.

LIFTING MACHINERY.

THOS. W. WARD, ALBION WORKS, SHEFFIELD. See Page 22.

MACHINE TOOLS.

THE SHANNON, LTD., Ropemaker St., London, E.C. See Page 78.

OFFICE APPLIANCES.

Have you seen our Advertisement on page ~~63~~ 48. A glance at it may save you £500 per annum.—ED. BENNIS & CO., Ltd., BOLTON.

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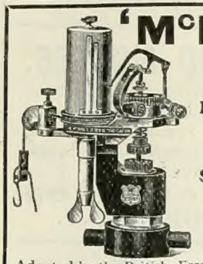

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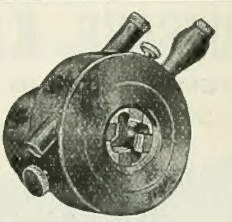

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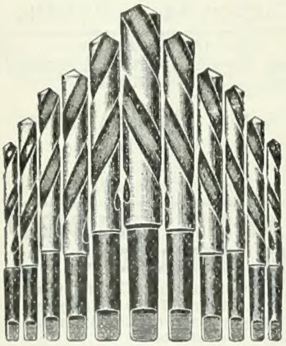

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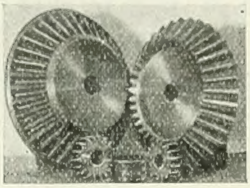

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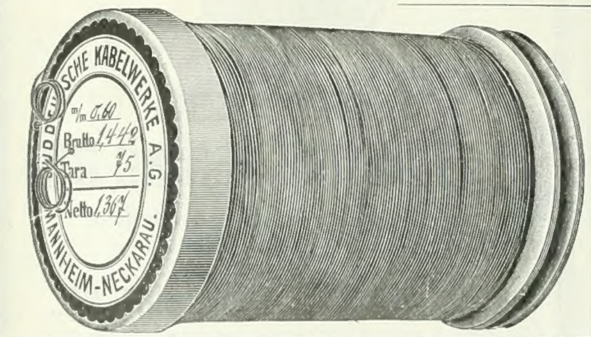

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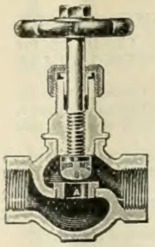

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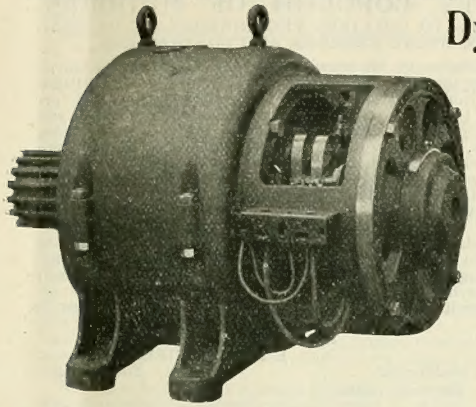

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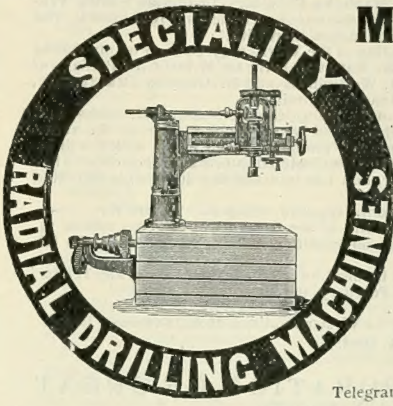

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PAGE'S WEEKLY Contracts

CONTRACTS.

WESTERN VALLEYS (MON.) SEWERAGE BOARD.

CONTRACT No. 1.

CONSTRUCTION OF MAIN OUTFALL AND BRANCH SEWERS.

Notice is Hereby Given that the Western Valleys (Mon.) Sewerage Board are prepared to receive TENDERS for the CONSTRUCTION of the above WORKS, consisting of the Main Outfall Sewer, Tank Sewer, and Sea Outfall, from Aberbeeg to low-water mark in the Bristol Channel, about 17½ miles in length varying from 2ft. 6in. to 11ft. in diameter, of brick, concrete, cast iron and steel; the Nantyglo Branch, from Nantyglo to Aberbeeg, about 6½ miles in length, varying from 12in. to 21in. in diameter, of earthenware and steel pipes; the Cwmtillery Branch, about 1¼ miles in length, 12in. and 15in, in diameter, of earthenware and steel pipes; the Ebbw Vale Branch, from Beaufort to Aberbeeg, about 8½ miles in length, varying from 12in. to 18in. in diameter, of earthenware and steel pipes; being a total length of about 35 miles, together with Penstock Chamber, Manholes, Chambers, Inspection Shafts, Ventilators, Penstocks, Storm Overflows, Connecting Chambers, and Miscellaneous Works in connection therewith.

Drawings and Specification of the Works may be seen at my offices as below, at the offices of Mr. BALDWIN LATHAM, M.Inst.C.E., Parliament Mansions, Victoria Street, Westminster, and Mr. GEORGE CHATTERTON, M.Inst.C.E., 6, The Sanctuary, Westminster.

A limited number only of the quantities, specifications, schedules, and forms of Tender are available, and may be obtained from the above Engineers, on deposit of £25 (crossed cheque only), which will be returned, after a contract has been entered into, to every person who has sent in a *bonâ fide* Tender, and has returned the documents entrusted to him.

Sealed Tenders on the forms supplied, endorsed "Tender for——— Sewerage Works, Contract No. 1," are to be delivered at my offices, 24, Stow Hill, Newport, Mon., on or before 11 a.m., on Saturday, the 8th day of April, 1905.

The Board do not bind themselves to accept the lowest or any Tender.

Dated this 10th day of February, 1905.

T. S. EDWARDS,
Clerk to the Western Valleys (Mon.) Sewerage Board.

24, Stow Hill, Newport, Mon.

THE CORPORATION OF GREAT YARMOUTH.

ELECTRIC LIGHTING.

The Corporation of Great Yarmouth invite TENDERS for the SUPPLY and DELIVERY of:—

SECTION 3.—SURFACE CONDENSER, with STEAM-DRIVEN AIR and CIRCULATING PUMPS.

Copies of the specification, with general conditions and form of Tender, may be obtained at the offices of Messrs. PREECE AND CARDEW, 8, Queen Anne's Gate, Westminster, S.W., upon payment of One Guinea, which will be returned upon receipt of a *bonâ fide* Tender.

Extra copies of the specification can be obtained upon payment of 5s. each copy (which will not be returnable).

Sealed Tenders, endorsed "Electric Lighting," must be delivered at the Town Hall, not later than 12 noon, on Wednesday, March 29th, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.

By order,
W. EDGAR STEPHENS,
Town Clerk.

Town Hall, Great Yarmouth,
March, 1905.

THE SECRETARY OF STATE FOR India in Council is prepared to receive TENDERS from such persons as may be willing to supply:—

BRIDGEWORK, 100ft. Spans.

The conditions of contract may be obtained on application to the Director-General of Stores, India Office, Whitehall, S.W., and Tenders are to be delivered at that office by Two o'clock p.m. on Tuesday, March 21st, 1905, after which time no Tender will be received.

E. GRANT BURLS,
Director-General of Stores.

India Office, Whitehall,
March 8th, 1905.

VICTORIAN RAILWAYS. — TENDERS are invited for the MANUFACTURE, SUPPLY, and DELIVERY of STEEL RAILS and FISH-PLATES.

Tenders, accompanied by the preliminary deposit of £250, must be lodged in the Tender Box at the Railway Offices, Melbourne, Victoria, Australia, or at the office of the Agent-General for Victoria, 142, Queen Victoria Street, London, E.C., before 1 p.m., on Monday, April 10th, 1905.

Charge for specification with drawing, 7s. 6d.

CLYDE NAVIGATION.—TO MECHANICAL AND ELECTRICAL ENGINEERS.

ELECTRIC POWER GENERATING AND LIGHTING PLANT.

The Trustees of the Clyde Navigation invite TENDERS for ELECTRIC POWER GENERATING and LIGHTING PLANT for Clydebank Dock.

Copies of the general specification, with form of Tender, are to be had at this office, from Mr. GEO. H. BAXTER, the Mechanical Engineer, on payment of £3 3s., which will be refunded on receipt of a *bonâ fide* Tender.

Sealed Tenders, marked "Tender for Electric Generating Plant," to be lodged with the undersigned not later than Monday, April 10th, 1905.

The Trustees may not accept the lowest or any Tender.

T. R. MACKENZIE,
General Manager and Secretary.

16, Robertson Street, Glasgow,
March 10th, 1905.

COUNTY BOROUGH OF HUDDERSFIELD.—TO COLLIERY PROPRIETORS, MECHANICAL ENGINEERS, METAL BROKERS, AND CONTRACTORS.

The Corporation of Huddersfield have FOR SALE and invite TENDERS for the PURCHASE of a DEEP LIFT MINE PUMPING ENGINE, capable of raising from 100 to 1,000 gallons of water per minute, with Quadrants and Connecting Rods, Plummer Blocks and Sole Plates, Spear Rods, and Bucket Pumps, including the Rising Main Fittings, and all accessories (exclusive of boilers) as now taken out of the well and stored on the ground at the Butterley Reservoir Works at Marsden, near Huddersfield.

A copy of the specifications may be obtained on application at the offices of the Waterworks Manager (Mr. J. W. SCHOFIELD), Town Hall, Huddersfield.

Sealed Tenders, endorsed "Tenders for Pumping Plant," must be delivered, free of charge, addressed in the handwriting of the tenderer or his agent, to the Town Clerk, Huddersfield, not later than Saturday, March 25th, 1905.

The Corporation do not bind themselves to accept the highest or any Tender.

By order,
J. HENRY FIELD,
Town Clerk.

Town Hall, Hudderfield,
March 6th, 1905.

EAST INDIAN RAILWAY.—THE EAST INDIAN RAILWAY COMPANY is prepared to receive TENDERS for the SUPPLY and DELIVERY of:—

FOUR DECK SPANS (59ft. 4in. in the clear),

as per specification to be seen at the Company's Offices.

Tenders to be sent to the undersigned, marked "Tender for Deck Spans," not later than Twelve o'clock noon on Wednesday, March 22nd instant.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of One Guinea is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG,
Secretary.

Nicholas Lane, London, E.C.,
March 9th, 1905.

THE SUTTON DISTRICT WATER COMPANY.

CONTRACT No. 1.

WATER SOFTENING WORKS.

TENDERS are invited for the CONSTRUCTION of an Engine and Pump House, Pump Well, Compressor Engine and Lime House, Softening and Lime Water Tanks, Laying and Jointing Cast Iron Pipes Laying Drains, Forming and Making of Paths and Roads, Driving Tunnel, and various other necessary Works at the Company's Pumping Station, Sutton, Surrey.

Tenders must be accompanied by complete priced bills of quantities and schedule of prices, the bills and schedule to be together in a separate sealed envelope, which will not be opened unless the Tender based upon same is provisionally accepted or permission is granted by the parties tendering. All bills and schedules will be returned except those from the contractor whose Tender is accepted.

Drawings may be seen and copies of the specification and bills of quantities obtained on and after Monday, March 6th, 1905, at the offices of the Engineer, W. VAUX GRAHAM, Esq., M.Inst.C.E., 5, Queen Anne's Gate, Westminster, on payment of £5, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders upon the form provided, endorsed "Tenders for Softening Works, Sutton," must be forwarded to P. ANDERSON, Esq., F.C.I.S., Secretary, The Sutton District Water Company, Carshalton Road, Sutton, Surrey, on or before Monday, the 20th day of March, 1905.

PAGE'S WEEKLY Contracts

CITY OF PETERBOROUGH.—WATERWORKS.

ETTON EXTENSION.—CONTRACT No. 3.

The Corporation of Peterborough are prepared to receive TENDERS for the SUPPLY and ERECTION of the following PLANT :—

SECTION No. 1.—Lancashire Boilers, Superheaters, and Economiser.

SECTION No. 2.—Triple-Expansion Vertical Engines, Pumps, Electric Lighting Set, Travelling Crane, Workshop Fittings, and Tools.

SECTION No. 3.—Piping, Injector, Feed Pump, Tank, and Feed-Water Softener.

The whole bound up in one specification.

Persons tendering are at liberty to Tender for any Section or Sections, but not for part of a Section.

Specifications, with terms and conditions, and forms of Tender may be obtained from the undersigned on deposit of Three Guineas, which will be returned on receipt of a *bona fide* Tender.

Sealed Tenders, endorsed "Tenders for Waterworks Plant," to be delivered at my office on or before Thursday, the 23rd day of March, 1905.

The contractor will be required to undertake to pay the standard rate of wages prevailing in the district.

The Corporation do not bind themselves to accept the lowest or any tender.
JOHN C. GILL, Assoc.M.Inst.C.E.
Waterworks Engineer's Office,
Peterborough, March 1st, 1905.

THE MADRAS RAILWAY COMPANY

are prepared to receive, until Twelve o'clock on Monday, March 27th, TENDERS for the SUPPLY and DELIVERY free on board, of Wrought Iron and Steel Bars, Sheets, Plates and Wire, Copper and Brass Sheets, Wire and Rivets, Zinc, Tin, Galvanised and Lead Sheets, Pig Lead, Files, Wood Screws, Nails, Chain, Vices, Picks, Shovels, Crowbars, Hammers, Wrenches, Braces, Augers, Carpenter's Tools, Door Bolts, Locks, Buckets, Copying Presses, Lamp Fittings, Cutlery, General Ironmongery, Canvas, Bunting, Wicks, Leather, Emery Cloth Brushes, Hammer Handles, Glass Sheet, Lenses, Globes and Gauge Glasses, Crockery, Fire-clay, Grindstones, Soaps, Tar, Red and White Lead, Paints, Acids, and Drysalteries, Turpentine, Varnishes, and Fog Signals, as per specifications to be seen at the Company's offices.

Tenders to be delivered in sealed envelopes addressed to the undersigned, endorsed "Tenders for Stores" (Part I., II., III., or IV., as the case may be).

The Directors do not bind themselves to accept the lowest or any Tender.

A charge (which cannot be returned) will be made for each copy of the specification.
W. H. COLE,
1, Broad Street Place, Secretary.
Finsbury Circus, London, E.C.,
March 9th, 1905.

BOROUGH OF KEIGHLEY.—The Electricity Committee is prepared to receive TENDERS for the following PLANT :—

CONTRACT No. 9.—ONE LANCASHIRE BOILER.

CONTRACT No. 10.—ONE 300 K.W. DIRECT-CURRENT STEAM DYNAMO. HIGH-SPEED ENCLOSED ENGINE.

Specifications may be obtained on or after March 6th from Mr. J. M. SMYTH, Borough Electrical Engineer, Electricity Works, on payment of One Guinea for each specification to Mr. ALFRED LISTER, Borough Treasurer, Town Hall, which fee will be returned on receipt of a *bonâ fide* Tender.

Extra copies may be had for 5s. each, which sum will not be returned.

Sealed Tenders, endorsed "Contract No. ——," and addressed to the Chairman of the Electricity Committee, Town Hall, must be delivered not later than 10 a.m. Monday, March 27th, 1905.

The Corporation do not bind themselves to accept the lowest or any Tender.
By order,
GEORGE BURR,
Town Hall, Keighley,
March 1st, 1905. Town Clerk.

COUNTY BOROUGH OF BOLTON.

COOLING TOWER AND CONDENSING APPARATUS.

The Electricity Committee of the Bolton Corporation invite TENDERS for the SUPPLY and ERECTION of COOLING TOWER and CONDENSING APPARATUS in connection with their Power Station.

Specification, Form of Tender, and full particulars may be obtained on application to Mr. ARTHUR A. DAY, A.M.I.C.E., M.I.E.E., Borough Electrical Engineer, Spa Road, Bolton.

Tenders, endorsed "Coolers and Condensers," must be delivered to the undersigned on or before March 30th, 1905.

The Committee do not bind themselves to accept the lowest or any Tender.
By order,
SAMUEL PARKER,
Town Hall, Bolton, Town Clerk (*pro tem.*).
February 24th, 1905.

URBAN DISTRICT OF RATHMINES AND RATHGAR.

The Rathmines and Rathgar Urban District Council invite TENDERS for CONDENSING PLANT.

Specifications and form of Tender may be had on application to Mr. GEORGE F. PILDITCH, A.M.I.E.E., Electricity Works, Rathmines.

Tenders sealed and marked "Tender for Condensing Plant," must be delivered to the undersigned on or before the 27th inst.

The Council do not bind themselves to accept the lowest or any Tender.
F. P. FAWCETT,
Town Hall, Rathmines, Co. Dublin, Clerk to the Council.
March 6th, 1905.

APPOINTMENTS OPEN.

CORPORATION OF LONDON.—OFFICE OF ENGINEER.

PUBLIC HEALTH DEPARTMENT.

The Corporation of London are prepared to receive APPLICATIONS for the OFFICE of ENGINEER to the Public Health Department.

The salary of the office will be £1,000 per annum, rising to a maximum of £1,500 per annum.

Candidates must not be over 50 years of age, and must be members of the Institution of Civil Engineers.

Associate Member of the Institution of Civil Engineers is not sufficient qualification.

Full particulars of the duties of the office, and form of application, may be obtained from the Town Clerk, Guildhall, E.C.

The last day for receiving applications on the prescribed form will be Saturday, March 18th next.
BELL,
Guildhall, Town Clerk.
February 25th, 1905.

INDIAN PUBLIC WORKS DEPARTMENT.

THE SECRETARY OF STATE FOR

India in Council will, in the Summer of 1905, make not less than ELEVEN APPOINTMENTS of ASSISTANT ENGINEER in the permanent establishment of the Indian Public Works Department, in addition to the appointments to be made from Coopers Hill College.

The age of candidates must not be less than 21, or more than 24, years on the 1st July, 1905.

A printed form of application, together with information regarding the conditions of the appointments and certain requirements laid down as to education and experience in engineering may be obtained from the Secretary Public Department, India Office, Whitehall, London, S.W.

The form of application is to be returned not later than Monday 1st May next.
A. GODLEY,
India Office, Under Secretary of State.
February 24th, 1905.

COUNTY OF LONDON.—EDUCATION ACTS, 1870 to 1903.

The London County Council invites APPLICATIONS for the following APPOINTMENTS in the Education Department :—

FOUR DIVISIONAL INSPECTORS, who will have the general superintendence of large districts, and give special attention to the co-ordination of education within their areas. Their chief duties will be to inspect pupil teachers' centres, secondary schools, training colleges, science and commercial centres, polytechnics, and all institutions for higher education aided by the Council. Candidates will be required to possess special qualifications in one of the following subjects : (1) English Language and Literature ; (2) Modern Languages ; (3) Mathematics and Science ; (4) Technology (including Mechanical and Electrical Engineering). The salary will be in each case £600 a year, rising by annual increments of £25 to a maximum salary of £800 a year.

ONE INSPECTOR of WOOD and METAL WORK, whose chief duties will be to inspect the teaching in Wood and Metal Work in manual training centres and elementary and secondary schools. He will also be required to inspect certain classes at polytechnics. The salary will be £400 a year, rising by annual increments of £20 to a maximum salary of £500 a year.

The persons appointed will be under the control of the Chief Inspector, and will be required to give their whole time to the duties of the office, and will in other respects be subject to the usual conditions attaching to the Council's service, particulars of which are given in the form of application.

In connection with the appointments there is no restriction with regard to sex.

Applications should be made on the official form to be obtained from the Clerk of the London County Council at the County Hall, Spring Gardens, S.W., or at the Education Offices, Victoria Embankment, W.C.

The applications must be sent in not later than 10 a.m. on Saturday, the 1st day of April, 1905, addressed to the Education Offices as above, and accompanied by copies of not more than three recent testimonials.

Canvassing, either directly or indirectly, will be held to be a disqualification for appointment.
Spring Gardens, S.W., G. L. GOMME,
March 2nd, 1905. Clerk of the London County Council.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages* 35, 37, 38, *and* 40.

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. *for each additional section.*

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street, City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
Hartley & Sugden, Ltd., Halifax.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C.
Stafford, Arthur, & Co., Denton, Manchester.

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie. Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House Finsbury Circus, London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.

BY ROYAL WARRANT TO H.M. THE KING

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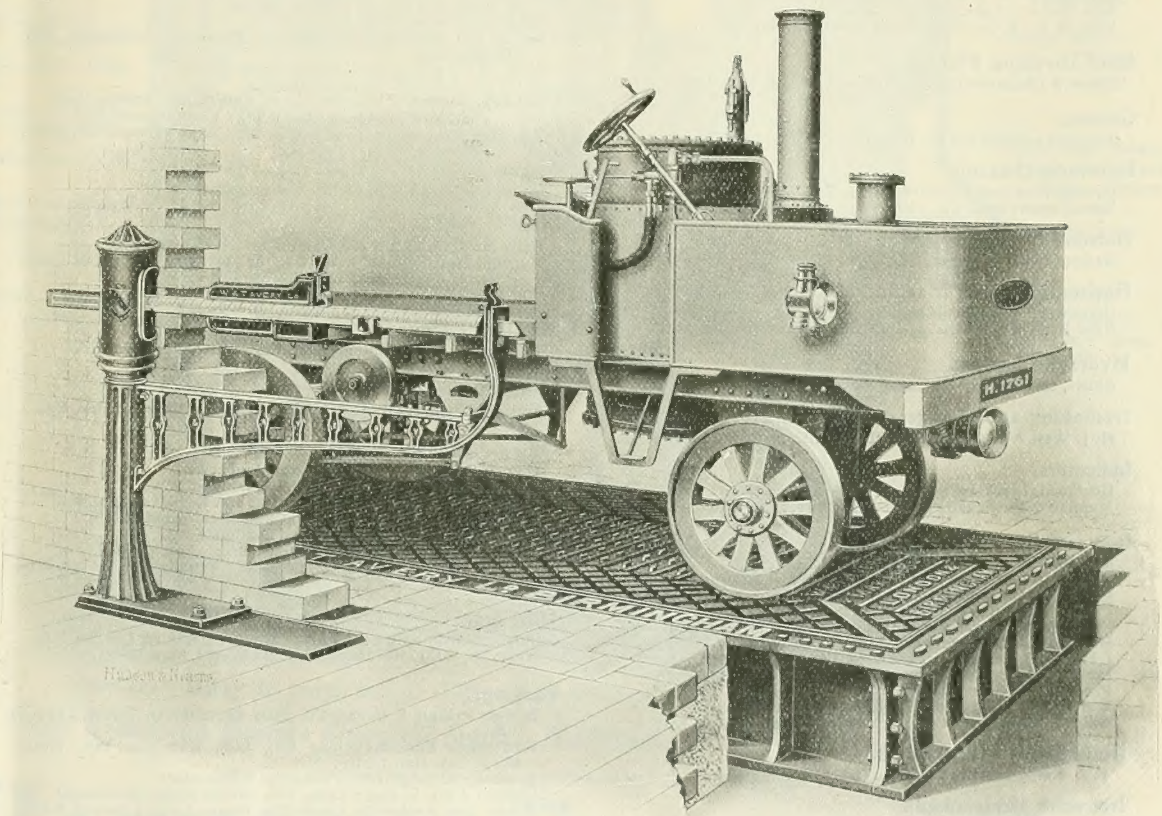
THE LARGEST MAKERS OF WEIGHBRIDGES IN THE WORLD



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M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

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Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C.
Reid Gear Co., Linwood, near Glasgow.
Wild, M. F., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co,, Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Eclipse Tool Manufacturing Co., Linwood, near Glasgow.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.

Lathe Carriers.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Mitchell, D., & Co., Ltd., Central Ironworks, Lawkholme, Keighley.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
G. F. Smith, Ltd., South Parade, Halifax.
John Stirk & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Winn, Charles. & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks.

Marks.
Pryor, Edward, & Son, 68, West Street, Sheffield.

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House, Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

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Official Trial.

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Diameter of Cylinders :—
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Rams, 3 Single Acting :
Each 30in. in dia.

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3 ft. 6 in.

Steam Pressure,
150 lbs.

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Saturated Steam per Indicated Horse Power per hour
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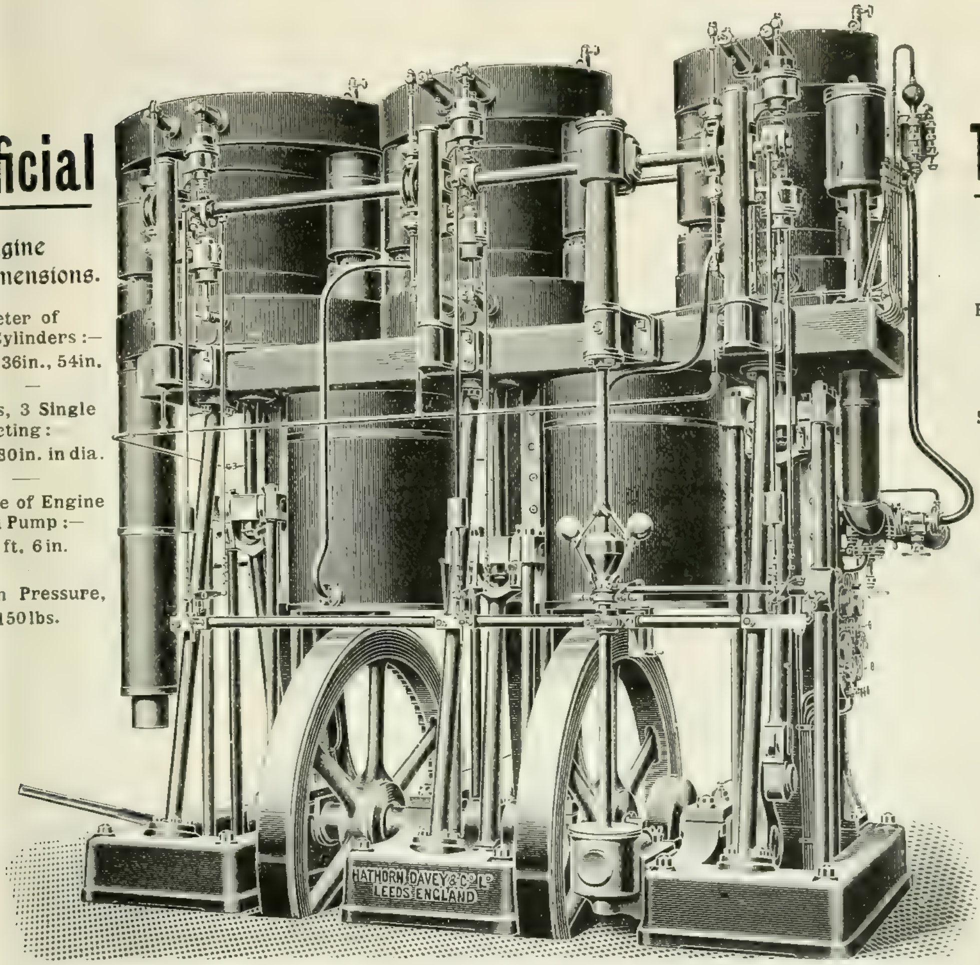
92·8 per cent.



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J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 39, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 69, Chancery London, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 135, Finsbury Pavement, London, E.C.

Pipe Wrenches (Chain).

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeitz & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pumps and Pumping Machinery.

Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Spanners.

Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stampings.

Thomas Smith & Sons of Saltley, Ltd., Birmingham.
Williams, J. H., & Co., Brooklyn, New York, U.S.A.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd. Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 10, St. George's Crescent, Liverpool, and 100, Queen Victoria Street, London, E.C.
Recorders, Ltd., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.
Winn, Charles, & Co., St. Thomas Works, Birmingham.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.

Lassen & Hjort, 52, Queen Victoria Street London, E.C.

Weighing Apparatus.

W. T. Avery & Co., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A, Midland Road, St. Pancras London, N.W.

Wind and Water Supply Machinery.

Eric S. A. Smith, Bridlington.

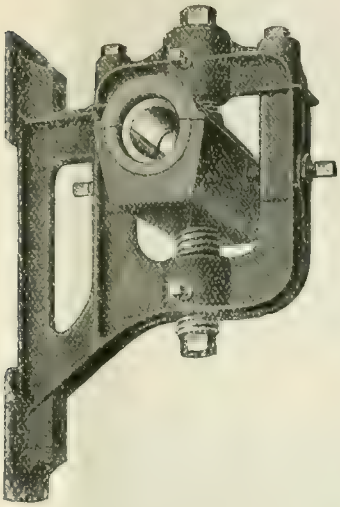
Wire Working Machinery.

Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."

"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY Miscellaneous



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Ring Oiling Ball and Socket Post Hangers.

ADJUSTABLE IN ALL DIRECTIONS.

These Hangers are **universally adjustable,** the bearing being susceptible of **movement in any direction.** In fact, the construction is such that **absolute self-adjustment is secured.**

Cast Iron Plungers with lathe-cut square threads are used to support the Bearing and **give vertical adjustment.** The bearing ends of these plungers are flat and come into contact with a convex surface running across the box at top and bottom. This surface is surrounded by a flange of oblong shape, which prevents the Bearing from slipping out of place longitudinally but is sufficiently wide to admit of liberal **self-adjustment laterally** by allowing the Bearing to move crosswise on the flat surface on the top and lower plungers.

WRITE FOR CATALOGUE No. 181.

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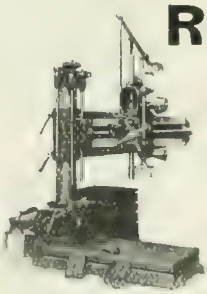

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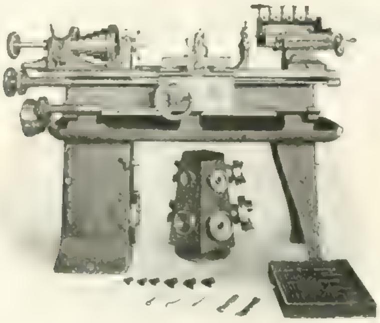
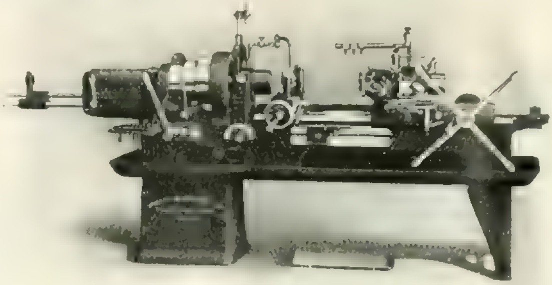


10 in. by 5 ft. Toolmakers Engine Lathe



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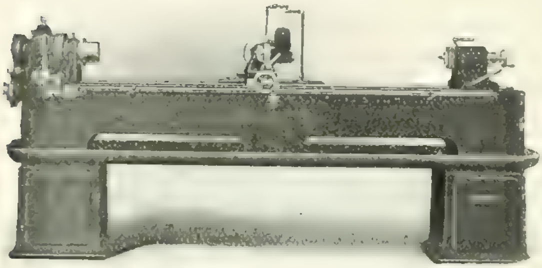

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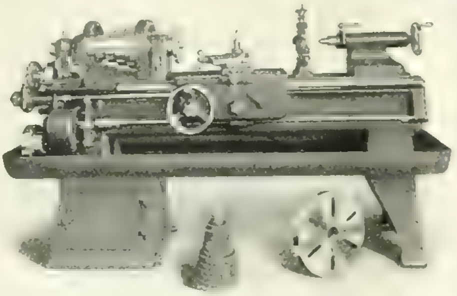

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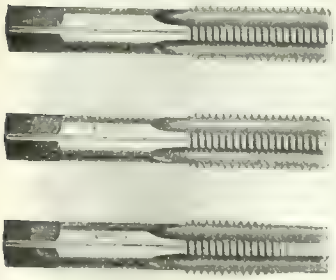

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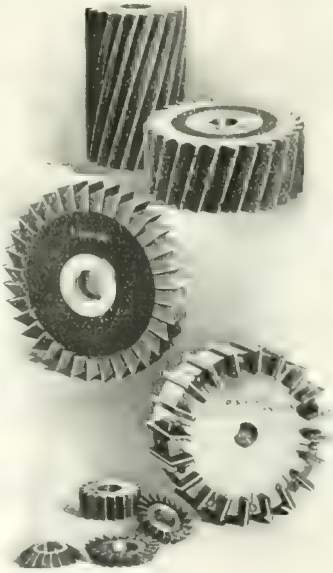

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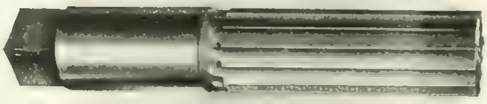

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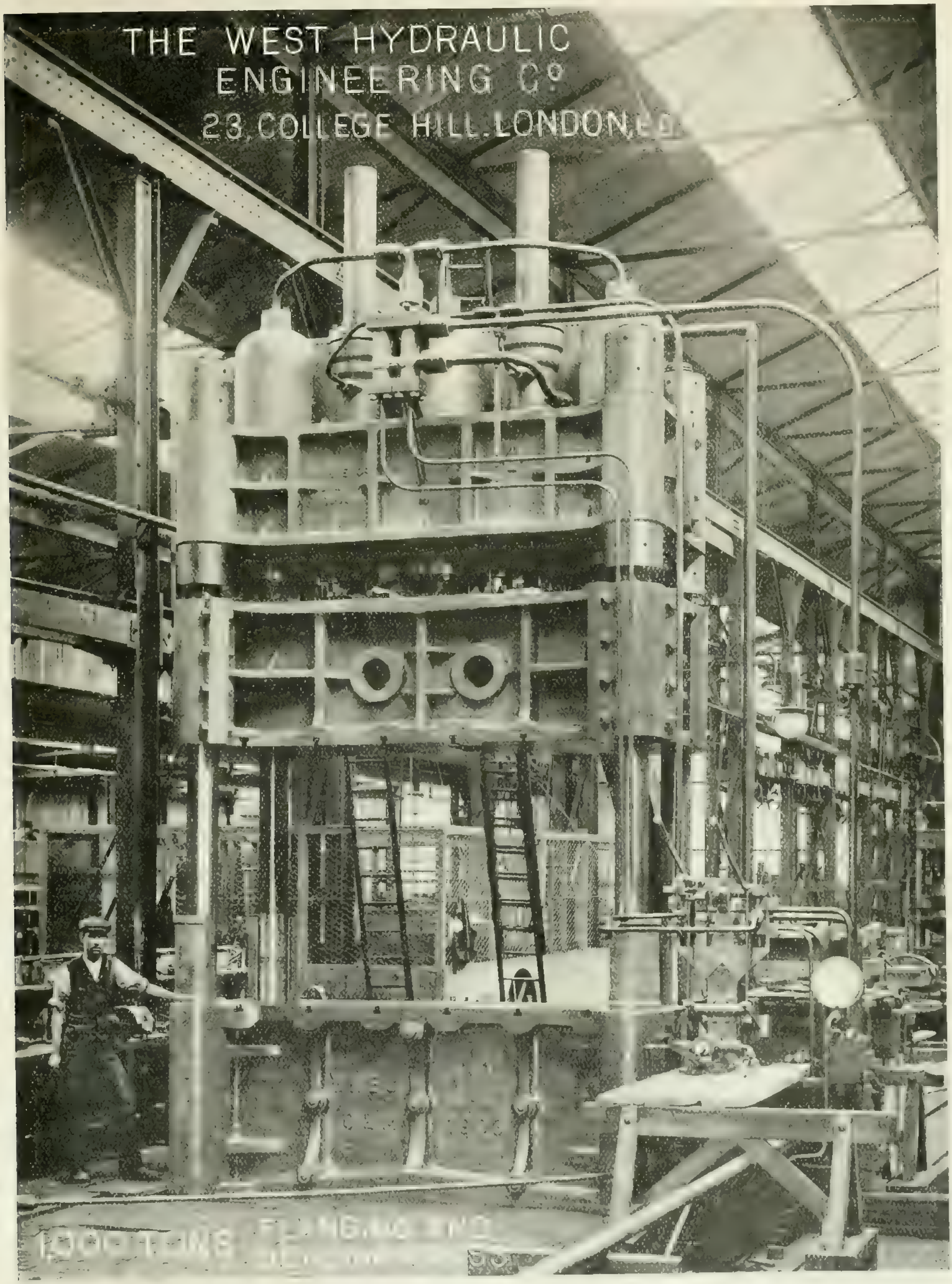

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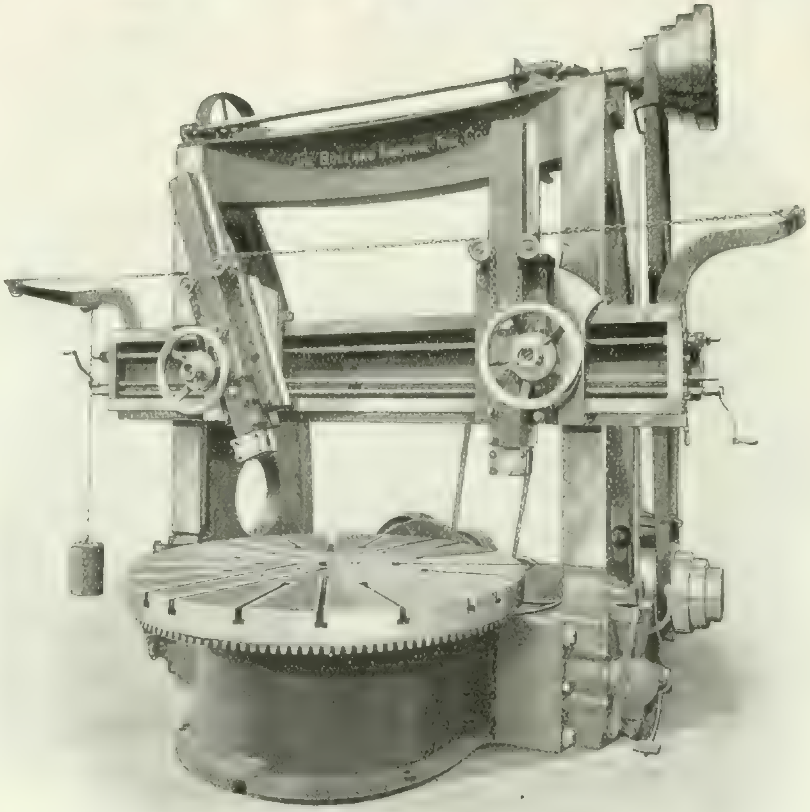

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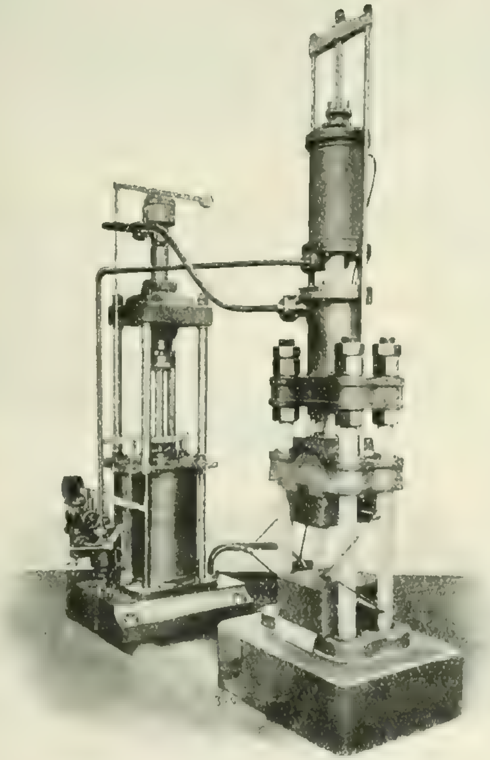

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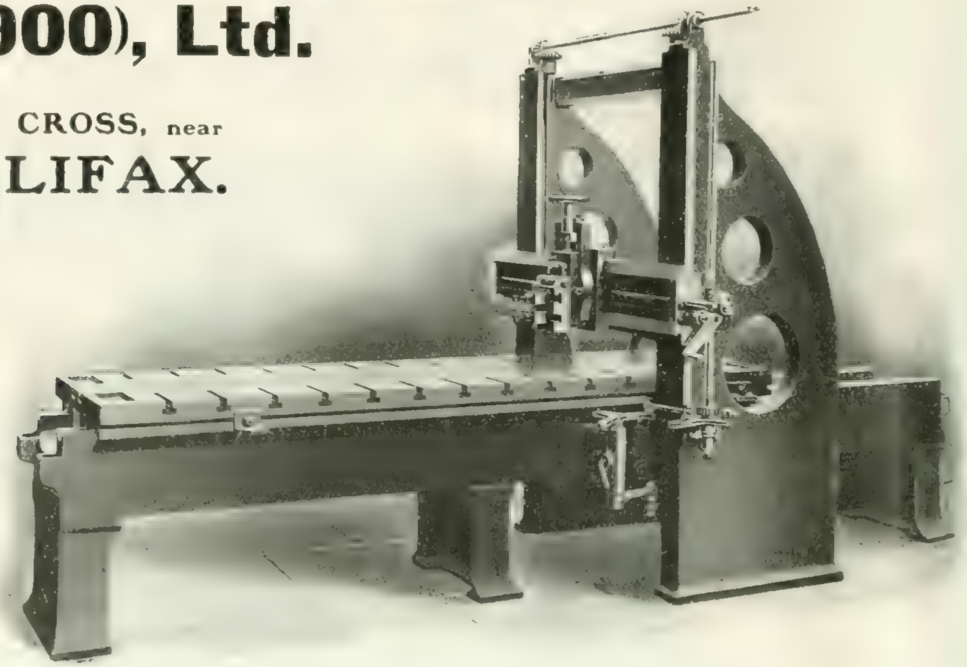

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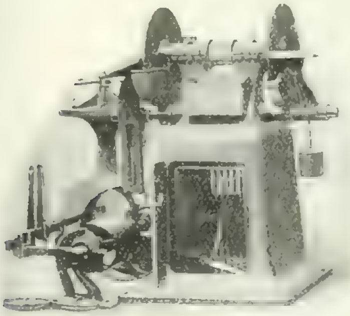

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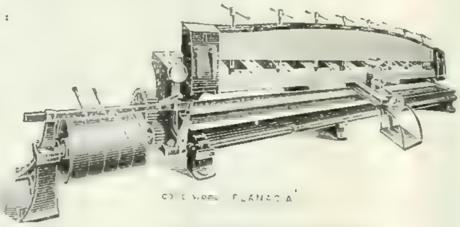

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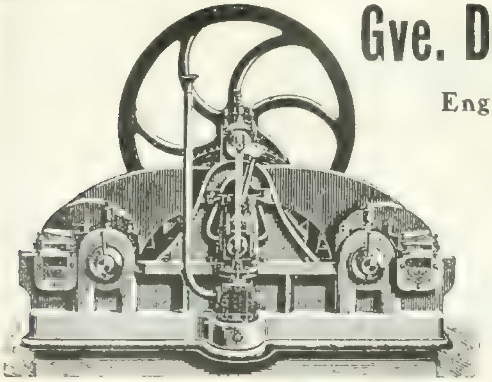

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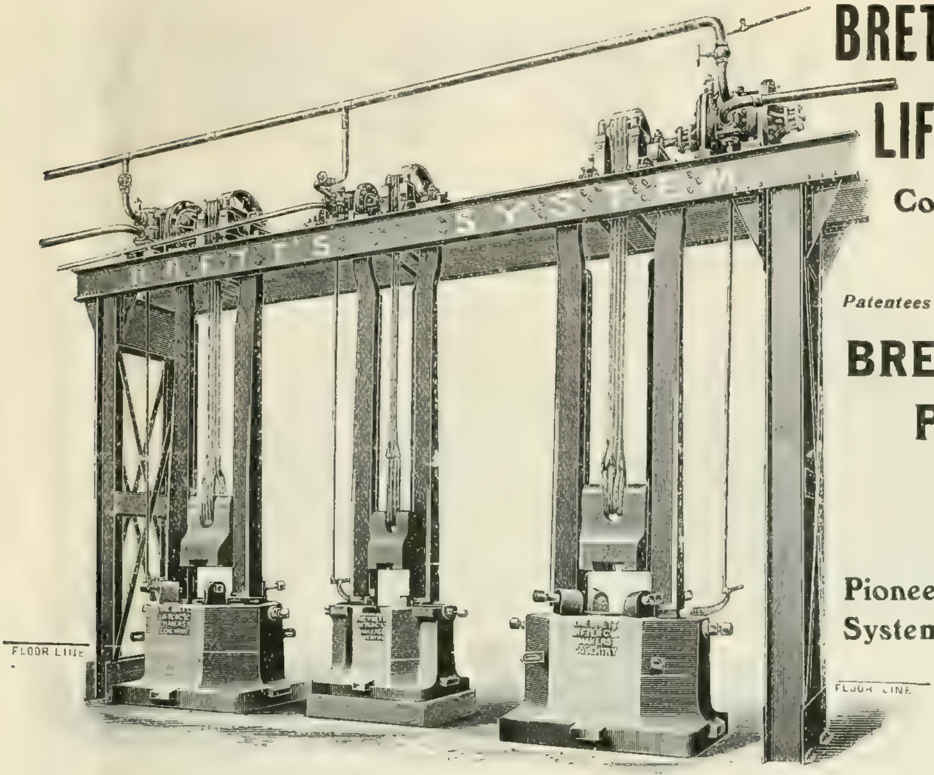

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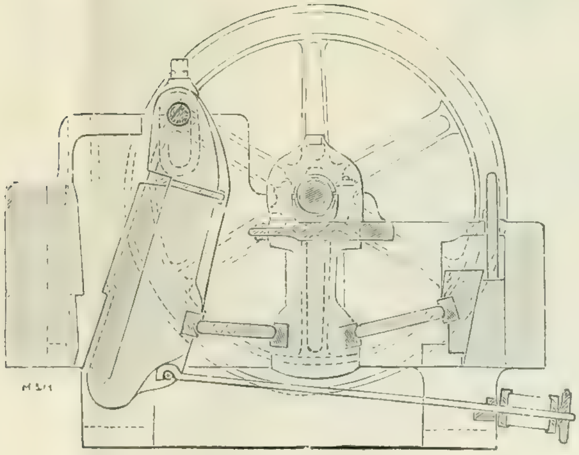

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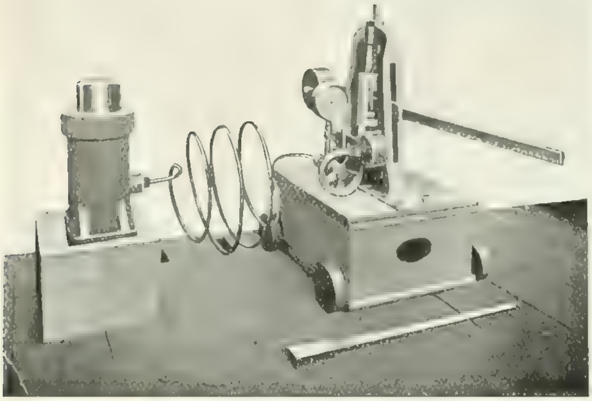

BOILER FLUE APPARATUS.

This illustration shows an apparatus for pushing up boiler flues. The cylinder and ram can be got into a flue of 24 in. diameter, and is capable of dealing with plates up to $\frac{3}{4}$ in. of thickness cold.

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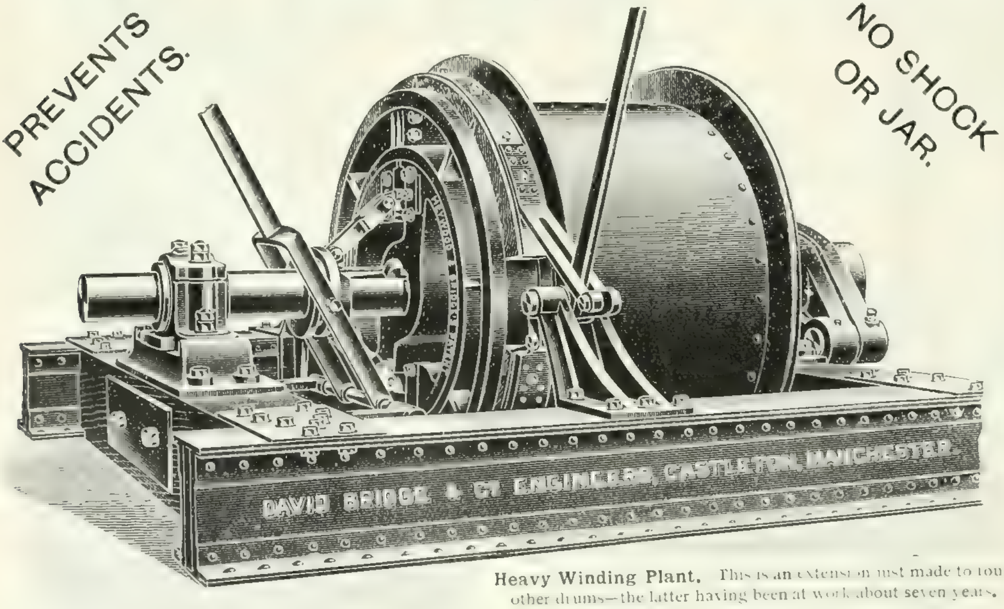
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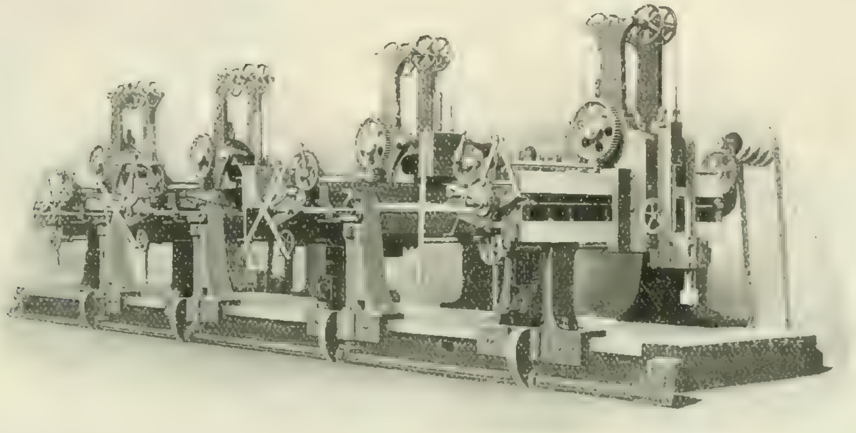

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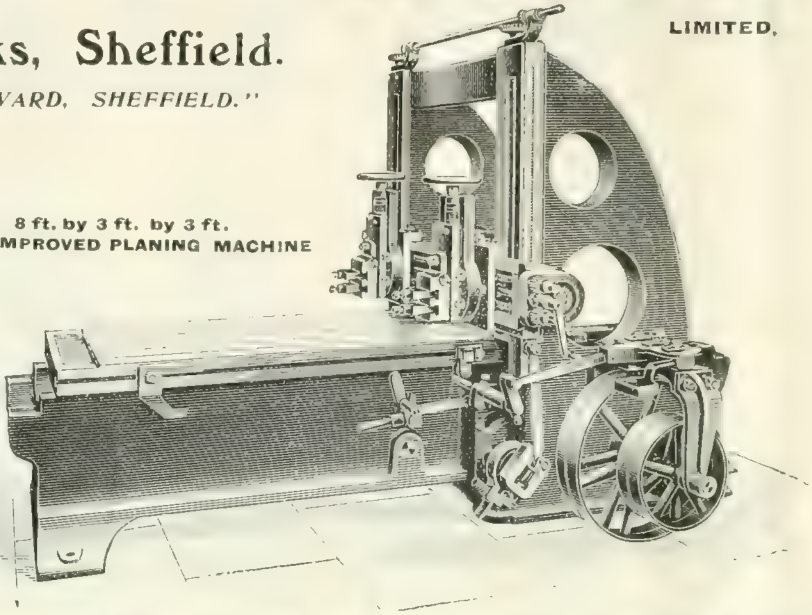

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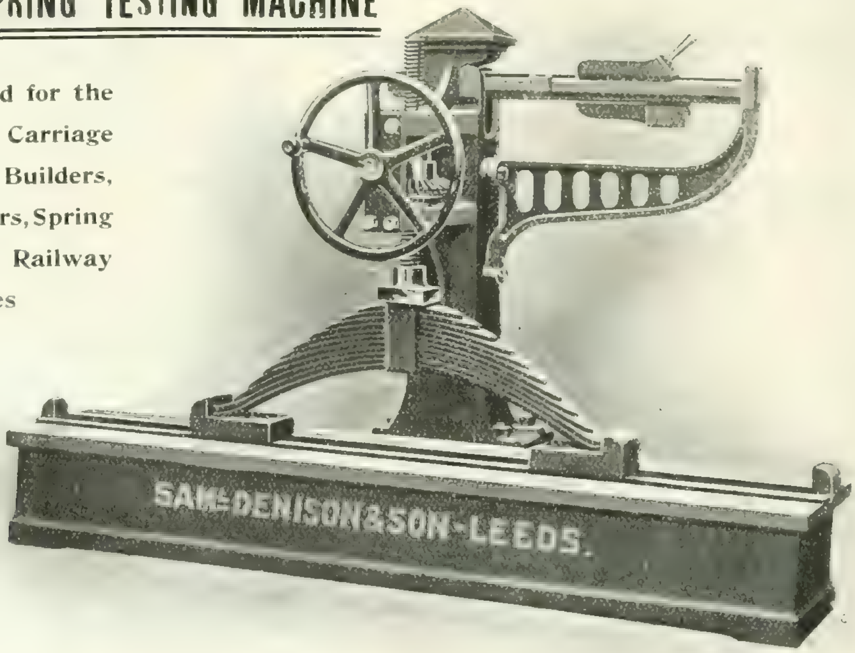

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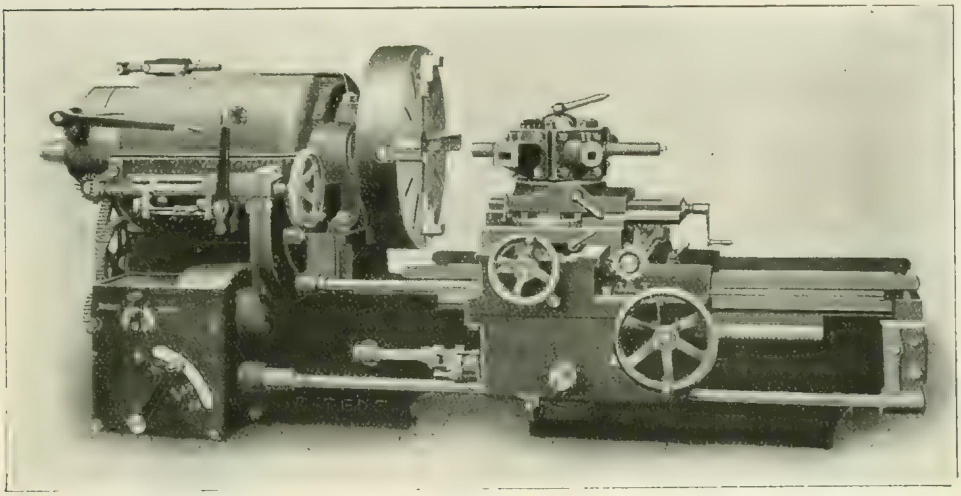

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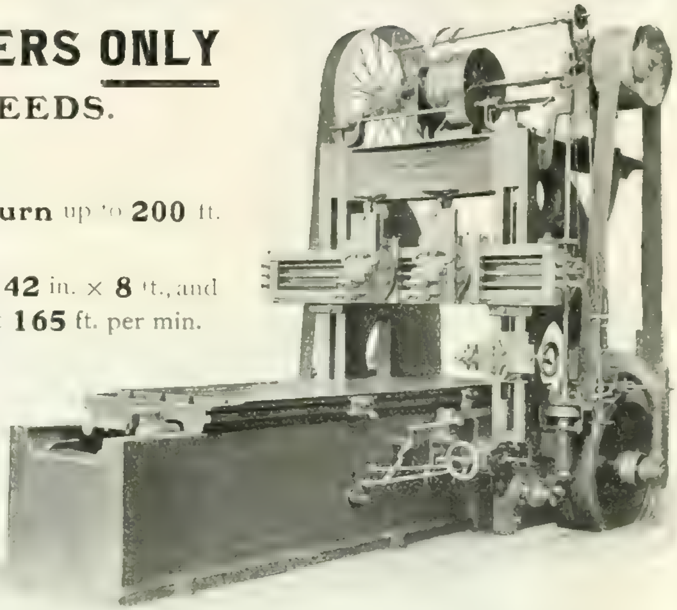

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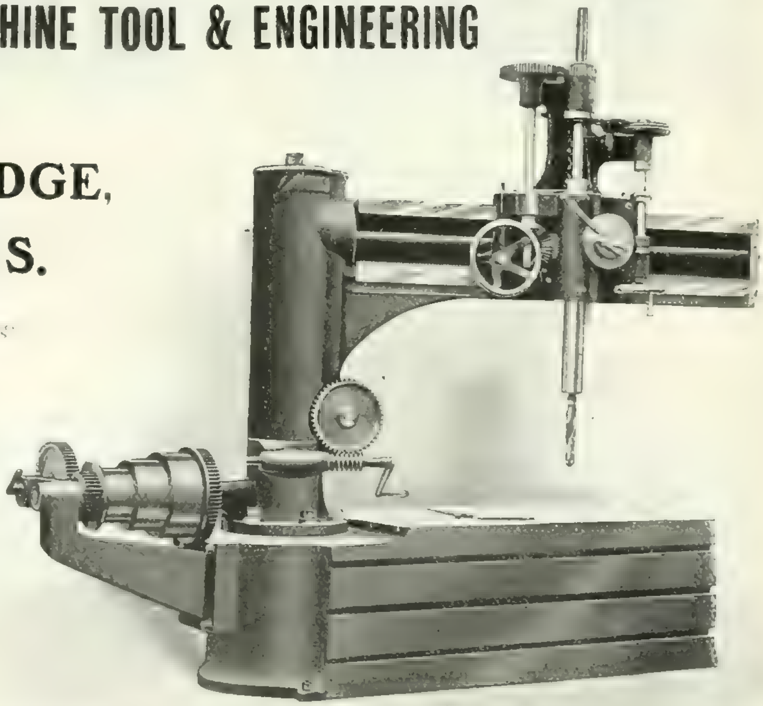

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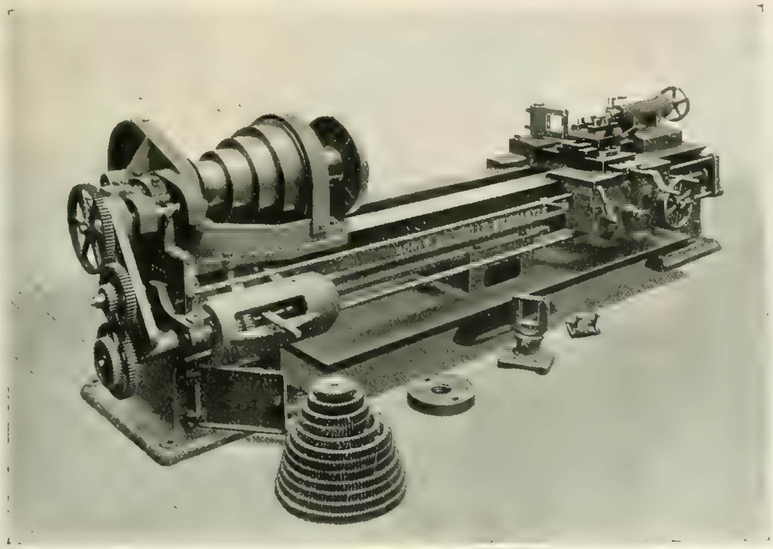

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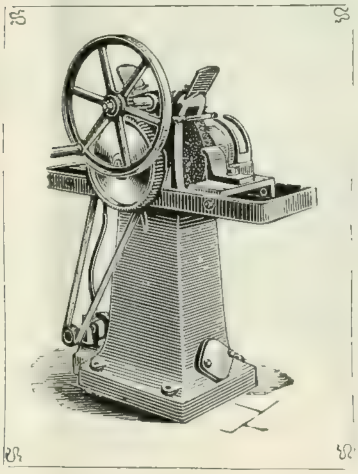

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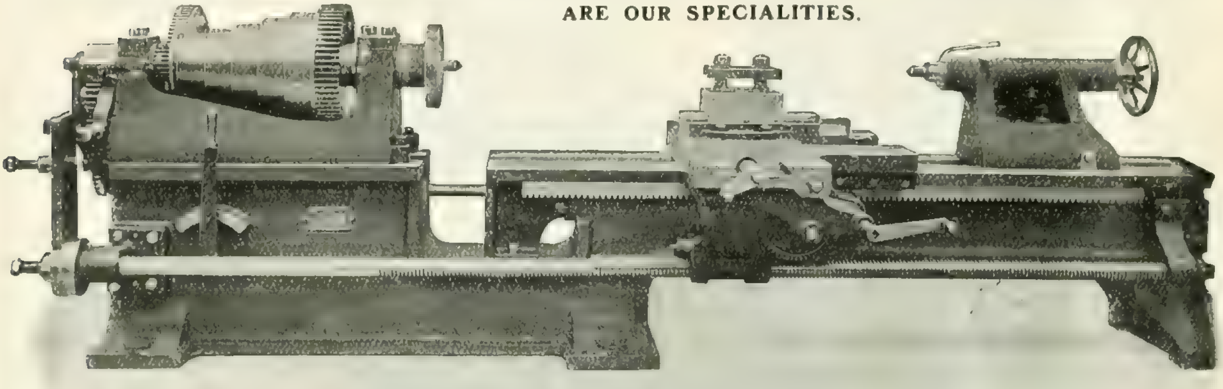

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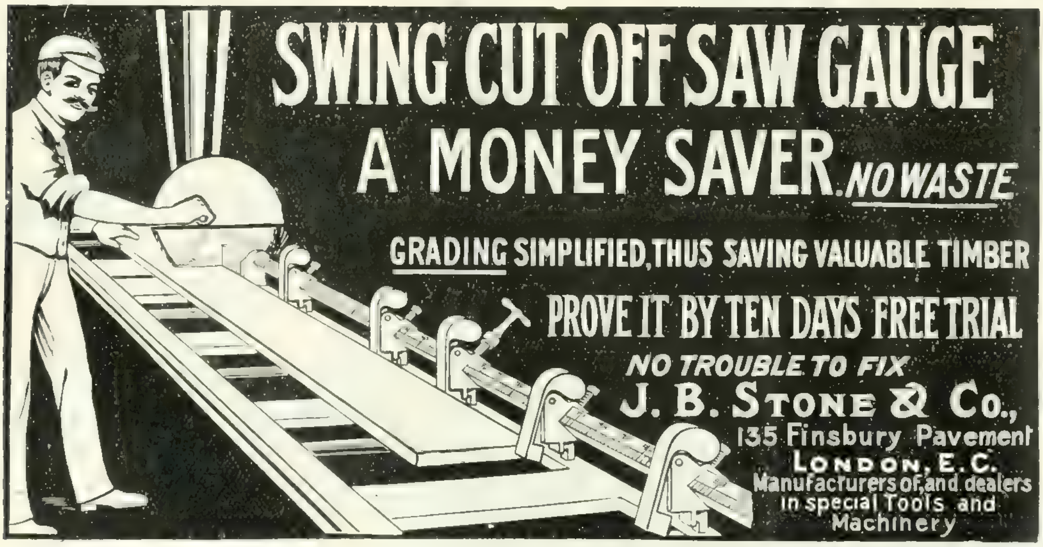

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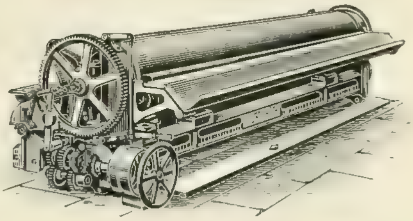

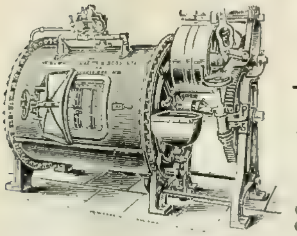

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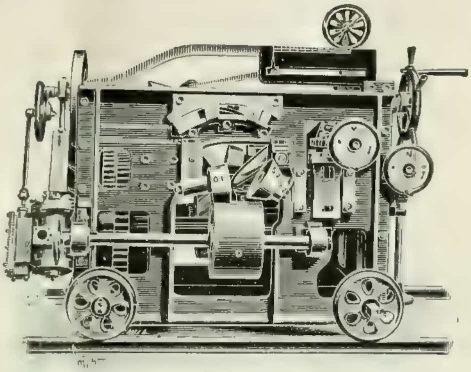

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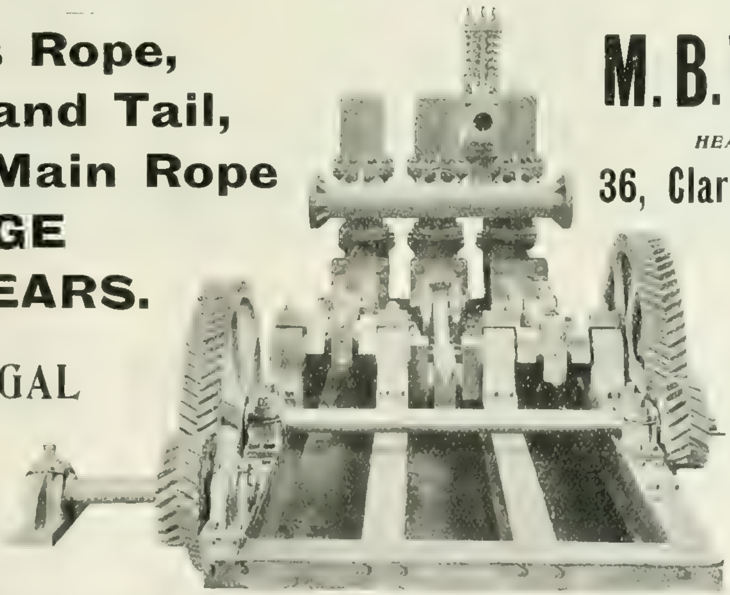

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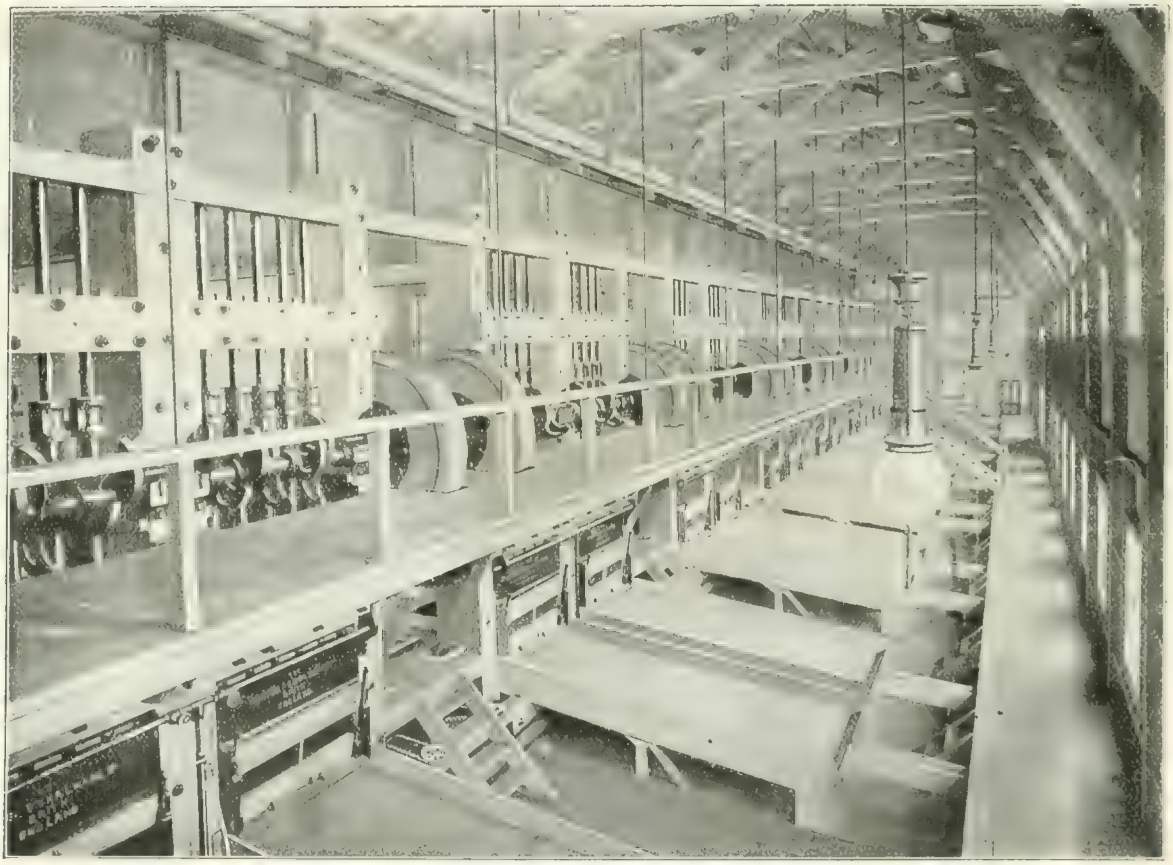

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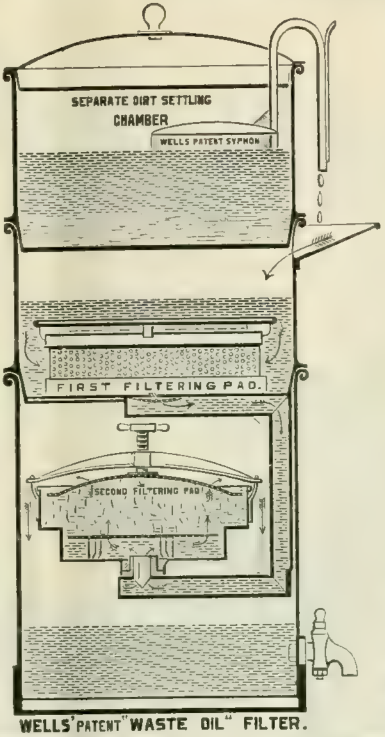

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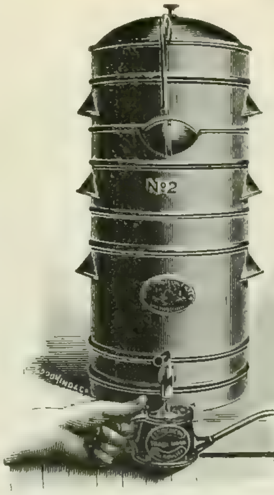

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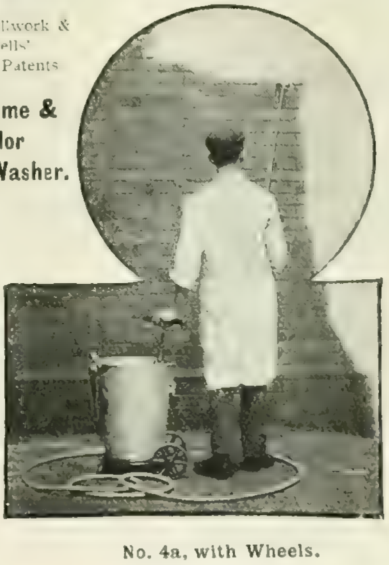

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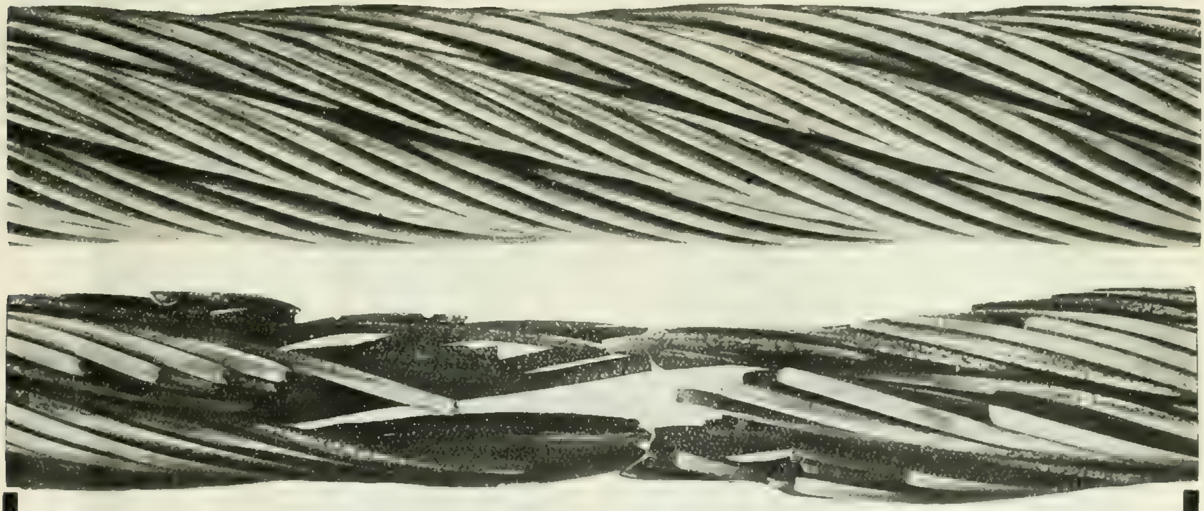

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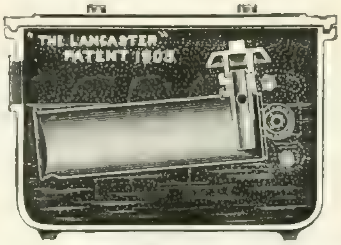

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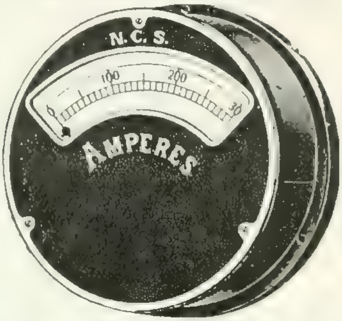

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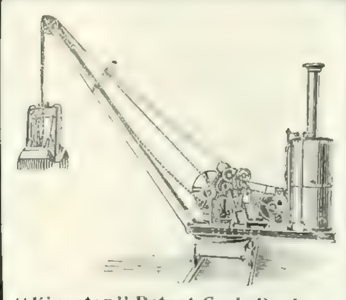

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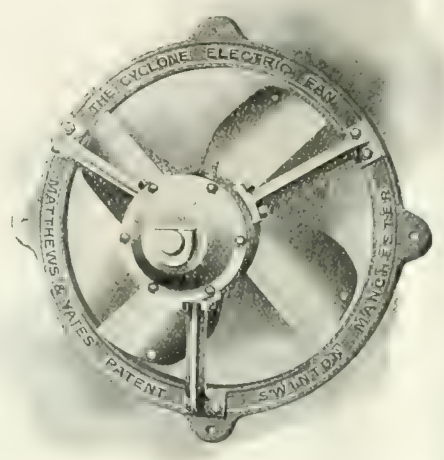

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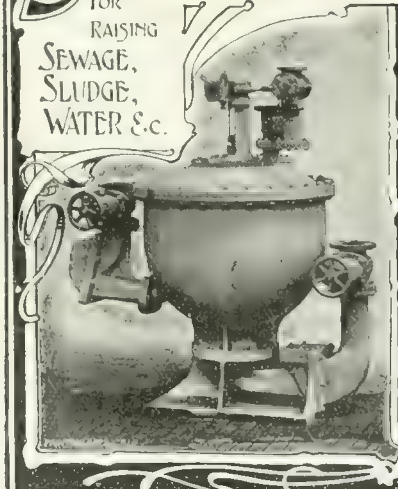

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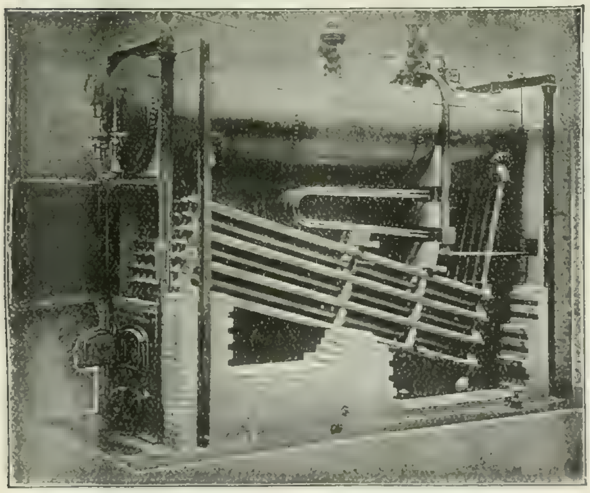

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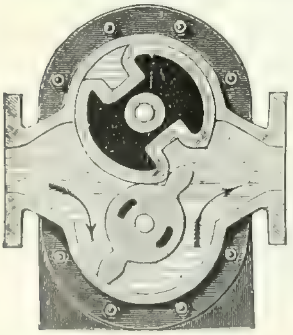

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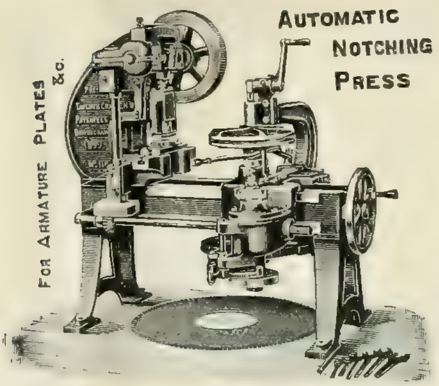

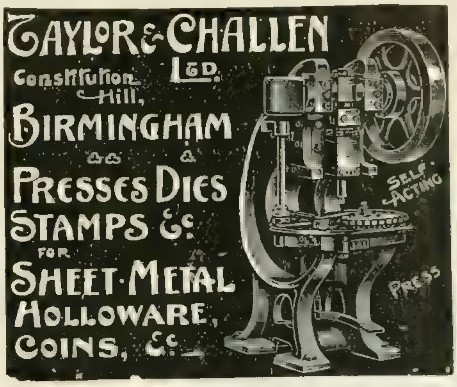

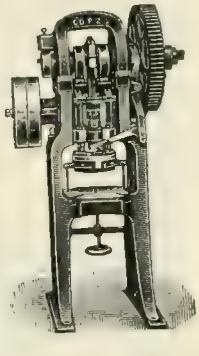
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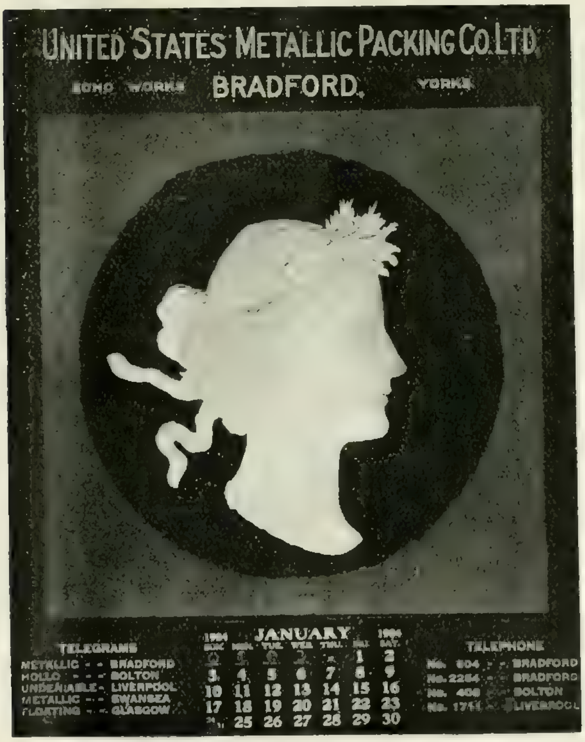

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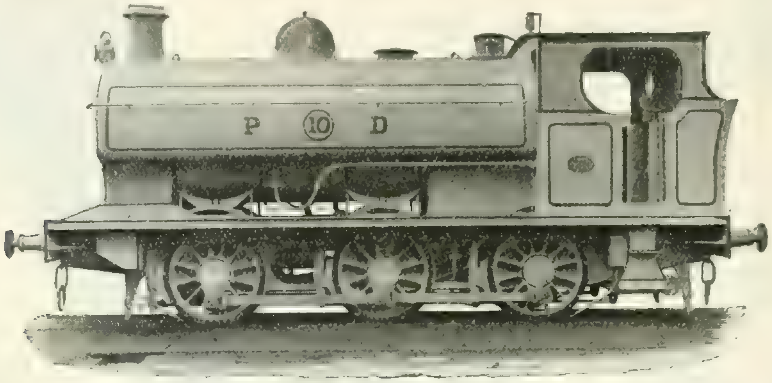

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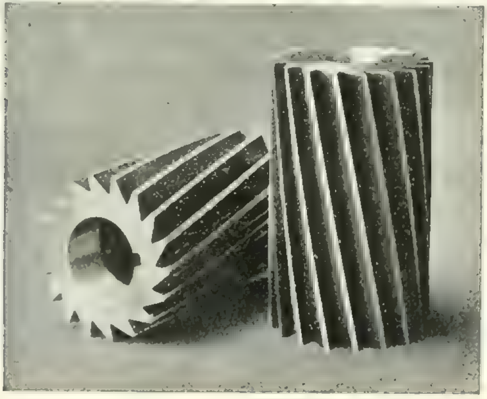

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PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VI. LONDON, FRIDAY, MARCH 17, 1905. No. 27.

The Offices of "Page's Weekly," Wednesday Evening.

WE are glad to see that the Times is calling attention to the form of protest which has been drawn up in opposition to the new Board of Trade Patent Rules. This list is now of a very influential and representative character. The point at issue concerns the market value of Letters Patent as it may be affected by an official endorsement recording the numbers of previous patents that may or may not anticipate the invention. The alternative suggested is that the patentee himself should be allowed to state in his specification that he is aware of previous applications, setting them forth in a concise form, the effect of which would be to show that he had patented the article with his eyes open to the state of the art, and that he believed himself to have accomplished something novel and useful. Those who are anxious to consider for themselves the pros and cons of this question cannot do better than read the interesting discussion initiated a few weeks ago in these columns by Mr. B. H. Thwaite.

* * *

At the recent meeting of the South Staffordshire Mond Gas Company, Mr. Alfred Mond, presiding, said they hoped to begin very shortly making and distributing Mond gas. They had already a good many customers to take the gas, and were now in negotiation with one of the largest firms in the district for a large supply. Others were waiting to see the result, and as soon as they were satisfied that it would be an economy to use it—he did not anticipate this would take long, judging from the satisfactory report they had from the North—they felt sure there would be plenty of customers

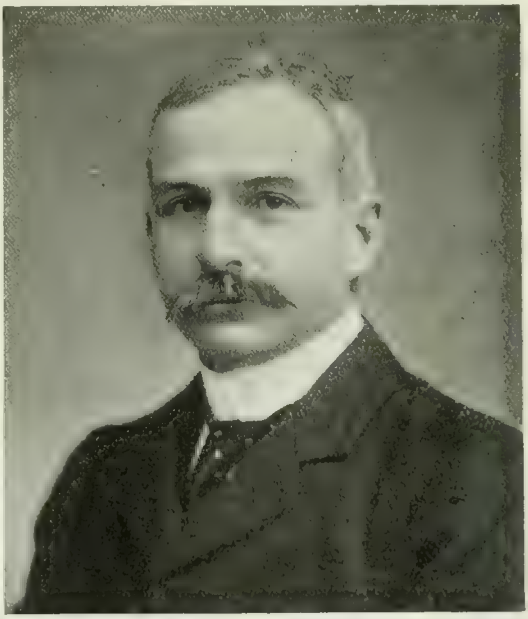
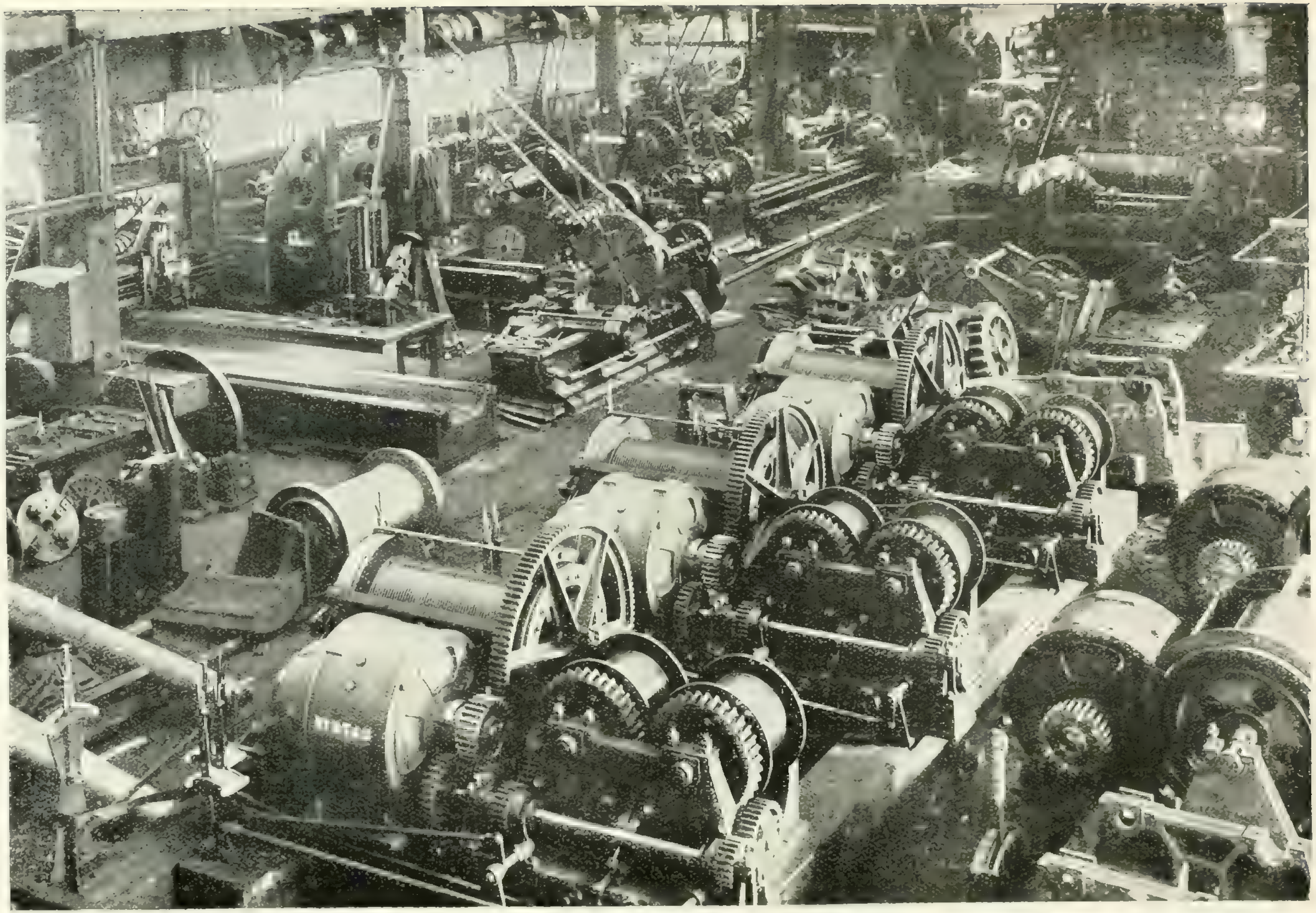


Photo by Elliott and Fry.]

MR. WILLIAM FRECHEVILLE, A.R.S.M., F.G.S.

Who has just been elected President of the Institution of Mining and Metallurgy.

Mr Frecheville was born in Canada in 1854, received his primary education at Berlin, and subsequently became a student at the Royal School of Mines, London. He has travelled very extensively, and gained mining experience in South Africa, Mexico, the United States, and India. During recent years he has had offices in London. He is a Member of the American Institution of Mining Engineers.



ELECTRICALLY EQUIPPED WINCHES FOR THE ADMIRALTY FLOATING COAL DEPOT, PORTSMOUTH.

The above view is from the **Witton Works** of the **General Electric Company, Ltd.**, and shows the application of sixteen **Witton Continuous Current Motors**, each of 35 to 40 b.h.p. to winches for use in connection with the **Temperley Transporters** installed on the **Admiralty Floating Coal Depot** (12,000 tons capacity) stationed at **Portsmouth Dockyard**.

The Company have also supplied four Witton Motors, each of 15 h.p., which are used for travelling the towers along the deck. It is interesting to note that the transporter in question can coal two battleships of the *Majestic* class at the same time, placing from 500 to 600 tons of coal per hour on board.

to take all the present make. Then would be the time to consider the enlargement of the works. They hoped in a few months to be able to distribute gas. They had made a contract with a large consumer which would enable them to dispose of a large quantity of gas on terms favourable to the company. The development of the scheme would take time, and that time would depend on the consumers and shareholders. They were anxious to do all they could to help the manufacturers to use the gas. He was glad to see there were many consumers beginning to take a more active part in the matter. Some people exaggerated the little difficulties that were met with. That the company would some day be one of the soundest companies in the country he had no reason to doubt, but neither he nor anyone else could say how long this would take.

The revenue accounts and analysis of working which are published as annexes to the most recent report on the Uganda Railway show that steady progress is being made in public traffic, excluding railway material. At the beginning of the year under review, the traffic working was carried on at considerable disadvantage owing to the line being still incomplete in many respects, while from April to September, 1903, heavy rains between the Mau Summit and the Lake terminus caused much delay, and undoubtedly interfered with the development of public business. The mean mileage worked during the year was 584 miles, the full extent of the railway. The point most noticeable in the year's working is the increase in the downward traffic from the Lake to the coast, as compared with the upward or import traffic, which remains, so far, almost stationary. This increase brings the downward traffic to 35 per cent. of the whole tonnage carried, as against $21\frac{3}{4}$ per cent. for 1902, and $11\frac{1}{6}$ per cent. for 1901. Much of this increase is due to the traffic brought in by the Lake steamers—traffic which has the great advantage, so far as the railway is concerned, of passing over its whole length.

In preparing the forecast of expenditure for working and maintaining the railway for the year under review it was estimated that the expenditure would exceed the receipts by £65,000. The actual deficit was, however, somewhat less, viz., £60,100. During the second half of the year the traffic was well maintained. The original estimates for the current year's (1904–1905) working showed a loss of £45,000, but the manager's revised estimates, prepared in November, 1904, show a deficit of £10,000 only, while it is expected that a further reduction will take place in 1905–1906. It should be remembered, in reference to this loss on working, that all Protectorate stores are carried at actual cost price—no profit being earned—and that, without the facilities afforded by the railway the cost to the State of holding Uganda and the head waters of the Nile would have reached a sum many times greater than this apparent deficit. The cost of carriage of the amount of Government stores now used in the Uganda Protectorate, by the old method of porters, would not only be sufficient to obliterate the deficit, but to pay a small percentage on the capital cost of the railway as well.

The results of the working of the Lake steamers are encouraging. For the first ten months, only one steamer was in service, the second having been launched and completed just in time to commence work in February, 1904. Arrangements have now been made for the provision of a third steamer. The traffic in the products of the country more than doubled during the year, and with the present large influx of whites who are desirous of settling in Uganda there is little doubt that, should these settlers find the country answers to their expectations, the imports will again increase. A further instalment of Mr. Leyland's article on the railway commences on page 577.

At the annual meeting of the Association of Mine Managers of the Transvaal, Mr. H. Ross Skinner, the retiring president, reviewed the work of the year in the mining industry from the practical point of view of the mine manager. He remarked that during 1904 the mining industry of the Transvaal had made greater progress than it had ever done in any individual year. This progress had been brought about by the great increase in the unskilled labour forces of the mines, mainly due to the successful introduction of the now proved Chinese. They started the year 1904 with about 75,500 natives in the coal and gold mines, and now the return was about 88,000 as the number of natives working on the fields on January 31st, an increase of about, say, 12,500. This total, added to the total Chinese at work and on the water, brought the unskilled labour army of the mines far ahead of what it had ever been. As regards Chinese, the first shipment arrived in the month of June, 1904, and on January 31st, 1905, there were 27,197 in full work along the reef and 7,514 on the water due to arrive on the mines at a very early date.

The full force of this great army of unskilled labour had not yet had time to make itself felt, but it needs no astute prophet to prophesy that in a few months' time the output of gold and profits to be derived from the Transvaal mines would exceed those of any pre-war days. Many causes would tend to this desirable state of things, the two main causes being increase of tonnage mined and treated, and decrease in working costs. Increase in tonnage would be brought about mainly by the augmentation of labour force, both skilled and unskilled; the decrease in costs by the greater efficiency of labour, reduced cost of stores, and last but not least the general tendency to a gradual improvement in the handling and management of the mines. In the pre-war days a mine considered itself lucky and its compound well managed if it could get an average of 80 per cent., or a little over, of its labourers daily at work; to-day the average percentage was 92, and some mines had reached 95 per cent. or over. This change was due to the strict suppression of the liquor traffic amongst natives, and to this trampling underfoot of the illicit liquor dealing they had to ascribe the quiet and peaceful week-ends on their mining properties instead of the drunken orgies which formerly took place every Sunday, lasting sometimes well into the week. Another great drawback, the old Pass Law, as it was administered, was now a thing of the past and almost forgotten. In its place they had a very much improved system, which was being most efficiently carried out. The native of to-day was better fed, better housed, and, when sick, better attended to than of old, and looking at the matter from a purely financial point of view, he was sure that the companies benefited by the change, and would do so, so long as the treatment of natives was carried out on the present common-sense lines, and provided that they did not run into extremes.

With reference to the health of underground workers, the condition of rock drill miners appeared to be much better. But those of them who came into contact with and had personal experience of these men realised how difficult it was to induce them to make use of the simplest precautions. Mine captains, shift bosses, and all complained of the difficulty experienced in inducing them to employ the proper and necessary preventatives. In his opinion, men working in ends and raises should be compelled by law to spray the faces of same at stated frequent intervals, and when boring up-holes, even with a water jet, to wear respirators. Mr. Skinner, it will be remembered, was the author of the now famous report on Chinese labour. The new president elected at this meeting was Mr. H. Spencer.

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.
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Alterations, &c. intended for insertion in the current week's issue must be delivered **not later than 4 p.m. on Monday.** If proofs are required the copy and blocks should reach us several days earlier.

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NEWS ITEMS.

Mr. W. B. Worthington, engineer of the Lancashire and Yorkshire Railway, has accepted the post of engineer-in-chief to the Midland Railway.

The late Mr. James Edward Ransome, chairman and managing director of the engineering firm of Ransomes, Sims, and Jefferies, Ltd., Ipswich, left property valued at £163,349 gross.

The title of the Mechanical Engineers' Association of the Witwatersrand is likely to be altered. It is certainly somewhat cumbersome. The new title proposed for the association is "The Transvaal Institute of Mechanical Engineers."

The Commission appointed by the Treasurer of Cape Colony to inquire into the financial position and general working of the Table Bay Harbour Board, urges that the authorised works, which will absorb £126,735, be proceeded with immediately.

Lord Kelvin will be the recipient of the first John Fritz gold medal awarded by the joint committee of the four national American engineering societies, under the deed of gift, to the man most representative of, and eminent in, scientific advance in the engineering field.

The transference of the locomotive works of the London and South-Western Railway Company from Nine Elms, London, S.W., to Eastleigh, Hampshire, will mean the removal of 3,000 employees with their families—about 12,000 persons in all. Most of these reside at Battersea.

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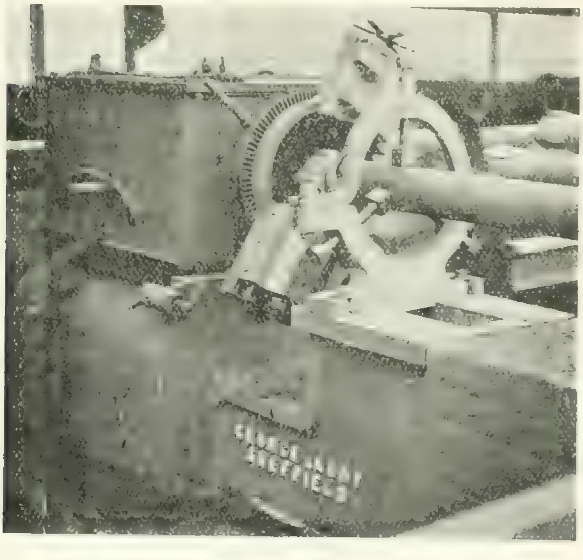
Bromley Destructor.

Bromley destructor, in which the fires were lighted last October, presents many points of special interest, and is one of the three destructors in which the refuse is tipped directly from the carts into the destructor cell without any intermediate handling or expenditure of labour whatever. The three destructors in question are situated at Westminster, Blackpool, and Bromley, and are all of the Horsfall type.

The tipping floor at Bromley is approached either by an inclined road or by a steam-driven hoist, which raises the horse and cart to the upper level. Having arrived on the tipping platform the cart is backed up to the feed hole of one of the three furnaces, the charging door is opened and the hopper lowered into its place. The cart tips its load bodily into the furnace, and the charging door is then immediately closed. The whole operation of opening the door, adjusting the hopper, tipping the cartload into the cell, raising the hopper, and closing the door, occupies less than half a minute. The door when closed dips all round into a water seal, which prevents the escape of smoke and dust, and also prevents the door from being burnt out.

Each cell is capable of burning from 10 to 15 tons of refuse per 24 hours. The hot gases pass out from the destructor by patent front exhaust flues, and are thoroughly mixed in a large combustion chamber contained within the furnace block before passing to the boiler. This is of the Babcock and Wilcox make of the improved marine type. It has 1,700 square feet heating surface, and a working pressure of 120 lb. per square inch. The boiler is capable of developing 250 h.p. It is provided with a direct acting flywheel feed pump and an injector as a standby.

The flues are carefully designed and built, and between the boiler and the chimney is fitted a centrifugal dustcatcher, the joint patent of Mr. Newton (borough engineer of Accrington), Mr. Diggle (the cleansing superintendent), and Mr. G. Watson (of the Horsfall Destructor Company). It consists of a circular chamber in which the gases are given a swirling motion causing the dust to be driven by centrifugal force through a narrow opening into the cleaning pit constructed on the outside of the dustcatcher. This arrangement has been proved capable of catching over 98 per cent. of the dust contained in flue gases, and it can be cleaned out at any time without interfering with the working of the plant.



NEW ELECTRICALLY DRIVEN CUTTING-OFF LATHE.

An Advance in Cast Iron Pipe Foundry Practice.

Electrically driven machines of all kinds are coming increasingly into general use owing to the fact that line shafting can be entirely dispensed with and the electrically driven tool can be dropped down as it were, in any part of the works without a thought having to be given to the presence in the immediate neighbourhood of shafting and pulleys. The accompanying illustration of an electrically driven cutting-off lathe gives an admirable example of the convenient manner by which work in cast-iron pipe foundries can be arranged.

The pipes, having left the foundry, are passed on to the fettlers, who, having completed their portion of work, roll the pipes down an inclined gangway to the electrically driven cutting-off lathe, which intercepts each pipe on its downward path, cuts off the rough end, and then allows the finished pipe to pass on to the dipping tank and the railway wagon. The cost of handling is thus enormously reduced.

The lathe has six changes of spindle speed without altering the speed of motor, and is fitted with an ingenious cutting-off head (Addy's Patent, No. 20,466), which is a great "time-saver," as the tools can be instantly brought up to the cut or instantly released by means of the projecting handles shown in photo.

The patent cutting-off head is equally suitable for cutting off large forged steel shafts, etc. The accompanying illustration is reproduced by the courtesy of Mr. George Addy, of Sheffield, who has devoted particular attention to the machines required by pipe founders, and we are informed that, in several cases, the cost of machining the pipes has been reduced by 50 per cent.

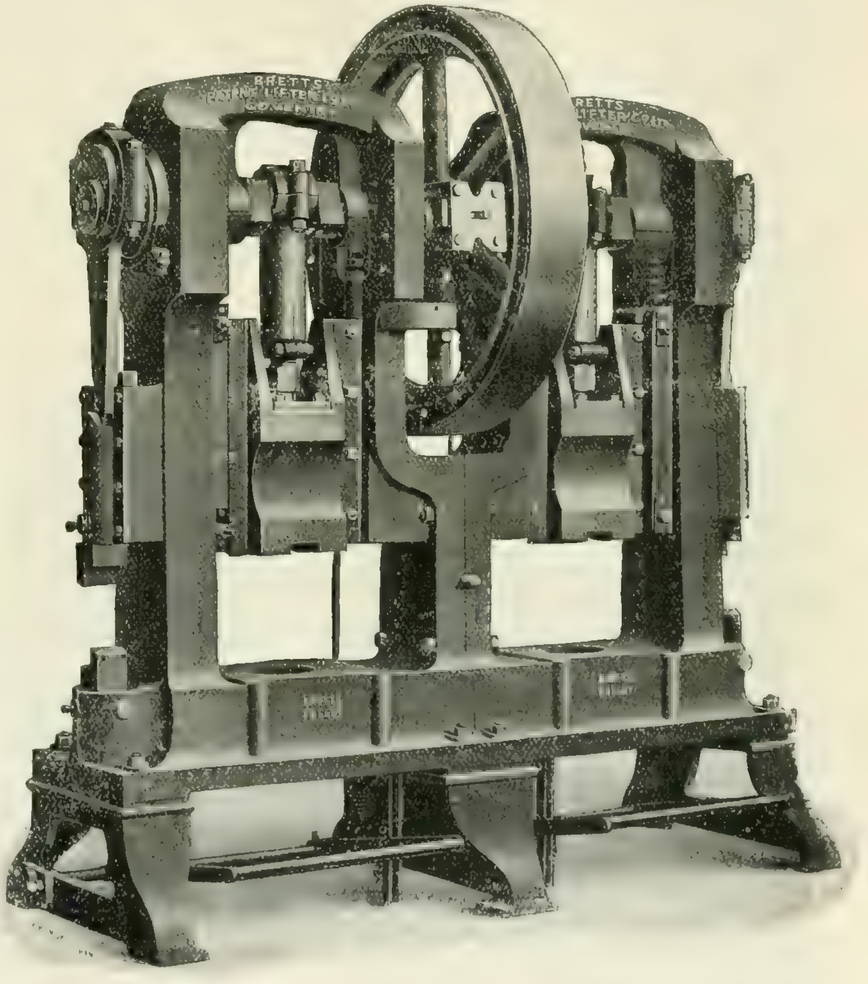
Clipping Press by Brett's Patent Lifter Co., Ltd.

The rapidly increasing use of accurately finished die stampings has led the Brett's Patent Lifter Company, Ltd., of Coventry, to design several forms of clipping presses specially adopted for this particular work, and the machine illustrated is one of their latest productions. In all forms of hot stamping with dies a certain amount of fin or flash is left at the joint where the faces of the top and bottom dies come together, and, although with accurately made and carefully set tools this is reduced to a minimum, it cannot be entirely avoided, and some system is necessary for its removal. In most modern works, where this method of die forging is adopted, it is now customary to provide for the purpose some form of press which is fixed side by side with, or in close proximity to, a furnace and stamp, so that each workman has a complete plantfor turning out a finished stamping.

The machine illustrated is in reality two complete presses but arranged for economy of space and convenience of working as a single machine, each part of which is operated quite independently of the other, and has in addition to the table for reception of the clipping or trimming dies, a separate pair of shears for cutting off the scrap ends from the bar on which the forging is made.

In every form of press for this purpose (or indeed for any other purpose where continual running is unsuitable) some ready and reliable form of starting motion by which a single stroke of the machine can be obtained is necessary, and by a very ingenious patented arrangement the machine not only contains this, but also ensures that the slide of the machine shall come to rest at the top of the stroke ready for the next operation, or that, if required, a continuity of strokes can be had. This has to be controlled by the foot.

The flywheel is fitted with a hardened steel square driving bolt, fixed either in the boss of the wheel as illustrated, or sometimes in the rim, but in either case free to slide sideways and having attached to it a finger piece passing at each revolution through a taper guide quadrant, so arranged that by depressing the foot lever it will be moved sideways, and draw the bolt in the wheel far enough to come in contact with the hardened face of a steel driving arm which is securely keyed on to the crank shaft and so made to revolve. On releasing the treadle the quadrant returns to its normal position and pushes back the driving bolt so that at the moment of passing the quadrant (or at top stroke), the arm on the shaft will be released and the machine stopped.



NEW CLIPPING PRESS FOR DIE STAMPINGS

Forthcoming International Congress at Liege.

In connection with the Liége Universal Exhibition, an International Congress of Mining, Metallurgy, Mechanics and Applied Geology will be held at Liege from June 26th to July 1st. As already announced, the Mechanical Engineers' meeting in Belgium closes on June 24th, so that members attending the meeting will have an excellent opportunity of attending the congress. The Congress is convened under the patronage of the Government, and is organised by the Union of Collieries, Mines and Ironworks in the Province of Liége and by the Liége Engineers' Association (Association des Ingénieurs sortis de l'Ecole de Liége). Further details will be given next week.

Meteorological Exhibition.

An exhibition of meteorological instruments, organised by the Royal Meteorological Society, was opened on Tuesday, in the library of the Institution of Civil Engineers, Great George-street, and remains open until to-day. Exhibits are contributed by the Meteorological Council, the Royal Meteorological Society, the National Physical Laboratory, the Astronomer Royal, Dr. H. R. Mill, and many private owners and makers. At one end of the room there is a collection of instruments, many self-recording, for registering the direction and force of the wind, including a couple that went to the Antarctic with the *Discovery*; and close by there is a series of sunshine-recorders of various types, some of which, used by the *Discovery*, had to be specially designed so as to give continuous records for 24 hours. The centre of the room is occupied by a typical "climatological station," fully equipped with dry bulb, wet bulb, maximum and minimum thermometers, all mounted in a Stevenson screen, rain gauge, sunshine recorder, earth thermometer, etc., as recommended by the Meteorological Society.

New Graving Dock.

The annual report of the Belfast Harbour Commissioners shows that the contractors, Messrs. Walter Scott and Middleton, Ltd., of London, have made fair progress with the new graving dock, and in connection with this work additional contracts have also been entered into with the following firms: Messrs. Andrew Barclay, Sons and Co., Ltd., of Kilmarnock, for engines and pumping machinery; Messrs. Hanna, Donald and Wilson, of Paisley, for travelling caisson and folding bridge; Messrs. Glenfield and Kennedy, of Kilmarnock, for penstock sluices and hydraulic appliances for pumping station, etc.; Messrs. J. Moore and Sons, Ltd., for keel blocks, and Messrs. H. and J. Martin, for the construction of a timber wharf.

It is stated that some of the Scotch shipbuilding firms have now enough work on hand to keep them busily employed for the next two years.

At the spring general meeting of the Marine Motor Association on the 30th inst. among the items for discussion will be Mr. William Cross's proposed new rule for ascertaining the power of steam motors, and a proposal that the Association should undertake the carrying out of official speed trials of motor boats and the issuing of certificates of speed performances.

At the annual meeting of the Leeds Forge Company, Ltd., last week, the chairman, Mr. Bernal Bagshawe, the new chairman of the Leeds Forge Company, Ltd., referred to the complete reorganisation of the steel-plate rolling plant. The most modern corrugating mil had been established, and the hammering of stee ingots had been abandoned. When in the United States recently he had seen nothing to surpass the new methods adopted at the Leeds Forge, but improvements at these works were still in progress.

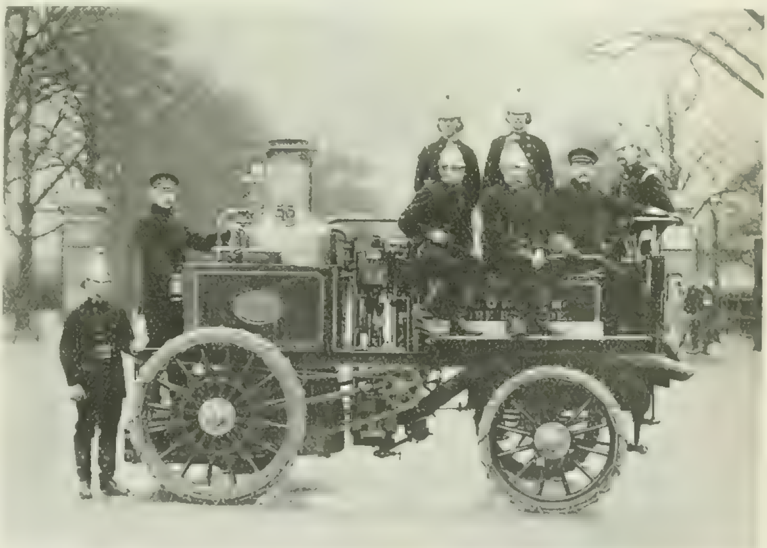
Without reference to repatriation, compound and dietary features, it has cost about £400,000 to "successfully introduce" the 27,200 Chinese employed on the Rand at the end of January. Some remarks by Mr. Skinner on Chinese labour and the general outlook will be found on page 560. If the 1904 basis of production elsewhere be maintained and not increased proportionately to that of these fields, it is calculated that the Transvaal in 1905 will contribute a third of the world's gold.

Cordingley's Motor-car Exhibition opens to-morrow at the Agricultural Hall, and will be continued until the following Saturday. This will be the tenth annual event of the kind which Mr. Charles Cordingley has organised at this hall, and we are informed that the latest types of touring and light vehicles will be on view, while the display of light delivery vans will give the event an interest for all who look to the motor-car to help in the solution of the difficulties of delivery experienced by commercial houses. In the heavy vehicle section there will be a large display of motor-'buses, municipal vans for street watering and the collection of dust lorries, etc. The Aero Club is organising a special display of balloons, airships, etc. During the week the annual meeting of the Motor Van and Wagon Users' Association will be held, and a reception will also be accorded to the borough and district engineers and surveyors who have been deputed by their authorities to make an inspection of the exhibits. The annual meeting of the Motor Union is also to be held during the week at the Agricultural Hall.

New Motor Steam Fire-Engine for the L.C.C.

THE new steam motor fire-engine supplied to the order of the London County Council for the London Fire Brigade, appears to have been rather unfortunate on its trial run to Sevenoaks. Several inaccurate versions of the incident having been given in the press, it may be well to briefly state the facts. It seems that the new engine got into some soft stuff on a by-road. In the efforts to get out of the ruts, a flaw in the countershaft opened out, and of course the engine was disabled. The flaw was in the ingot steel, and could not be discovered except by applying a breaking strain. A local motor-car tried to tow the steamer, but was not equal to the task. Messrs. Merryweather and Sons, Ltd., made a new crankshaft in a few hours, sent it down and fitted it on the spot, and the engine came home under its own steam.

In subsequent trials, we believe, the new steamer has given a highly satisfactory account of itself. It is the most powerful portable steamer in London, delivering 500 gallons per minute. The quick steam-raising water-tube boiler is fired with a new pattern petroleum burner. The machinery, which is placed vertically between the frames in front of the boiler, consists of a pair of inverted steam cylinders, driving two direct and double-acting pumps. The power for propulsion is taken from the crankshaft on this engine by putting a countershaft into gear, from which the road wheels are driven by a pair of steel roller chains running over sprocket wheels. The pump pistons can be disconnected from the engine, or, connected in a few seconds by a simple device, and thus only one set of machinery is required for propelling and pumping, saving a large number of working parts and consequent complications, which have been serious disadvantages in foreign-built motors. The new engine is steered by hand-wheel, with irreversible gear, and is controlled by levers for steam, reverse and brakes. A large hose box is fitted and eight firemen and engineer can be carried. The road wheels are of the artillery pattern, fitted with steel rims, solid rubber tyres, and Parsons' "non-skids." Similar engines are already in use in the fire brigades of Liverpool, Brighton, Portsmouth, Plymouth, Tottenham, Leyland, Heston, and Isleworth and other British towns, as well as abroad.

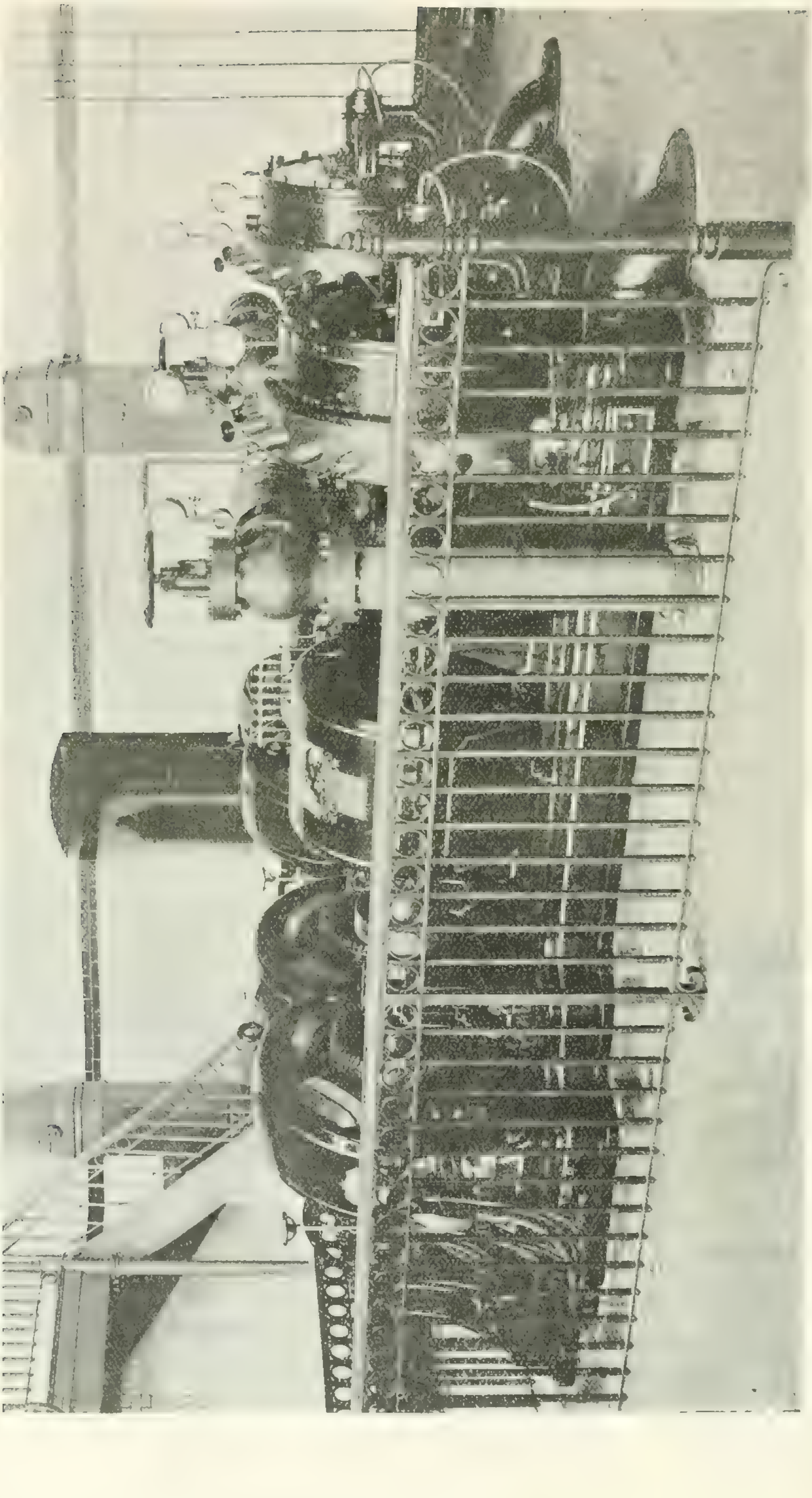


NEW MOTOR FIRE ENGINE FOR THE LONDON FIRE BRIGADE.

Delivery, 500 gallons per minute.

Turbine Steamer Contracts for the Clyde.

A correspondent of the Glasgow Herald states that it is now pretty certain that two of the new steamers for the Great Western Railway Company will be built by Messrs. John Brown and Co., Ltd., Clydebank, and the other one by Messrs. Cammel, Laird, and Co., of Birkenhead. These vessels are to be a little larger than Professor Bile's turbine steamers for the Midland Company, and will be fitted with a corresponding system of compound turbines, the speed in service between Milford and Rosslare on the Irish coast being 22 knots. This is the first Channel steamer with turbine machinery undertaken by the Clydebank firm, but few, if any, firms are so well able to ensure success in view of the extensive experiments carried out in connection with the two new Cunard vessels. In fact, Clydebank has been doing a great service to engineering in connection with these experiments, as they will show the way out of difficulties in recent turbine installations.



RECENT TURBINE INSTALLATIONS (V.)—DE LAVAL STEAM TURBINES, FORMING PART OF THE POWER PLANT OF THE ANHEUSER-BUSCH BREWING ASSOCIATION AT ST. LOUIS.

Recent Turbine Installations.

V.—DE LAVAL TURBINES FOR A BREWERY POWER PLANT.

The electric generating plant and refrigerating machinery of the Anheuser-Busch Brewing Association at St. Louis, are located in one building. The boiler house, which contains a battery of eleven 500 h.p. water-tube boilers, is about 500 ft. from the engine room. There are three main steam lines to the power and refrigerating plant, one 18-in., one 14-in., and one 12 in. line.

The electric power plant consists of two 750-h.p. vertical type compound Corliss condensing engines, built in 1901. These engines have 21-in. and 42-in. cylinders and a stroke of 48 in. Steam pressure is 140 lb. and speed 90 revolutions per minute. They are direct connected to 500-kilowatt general electric 240-volt direct current generators. These, with two 200-kilowatt De Laval steam turbine dynamos, give a total normal capacity of 1,400 kilowatts.

The two 300-boiler h.p. turbines are of the standard De Laval type, each direct connected to a pair of 200 kilowatt, 240-volt direct current Bullock generators, and operate under 140 lb. steam pressure and a vacuum of 27 in.

The steam guarantees given by the De Laval Steam Turbine Company in connection with these machines were as follows:—

Full load, 17·9 lb. or dry steam per b.h.p. per hour.
Half load, 20·1 lb. of dry steam per b.h.p. per hour.
Quarter load 24·9 lb. of dry steam per b.h.p. per hour.

These guarantees were for 140 lb. steam pressure and 26 in. vacuum.

The normal requirements of the plant are sufficient to keep one engine and one turbine fully loaded, thereby making it possible to hold one engine and one turbine in reserve at all times. The exhaust steam from the engines is led into a condenser of 1,500-h.p. capacity. Condensing water from the cooling towers is circulated through the condenser by a 10-in. centrifugal pump driven by a 50 h.p. Bullock direct current motor. The condensed steam and air are removed together by means of an Edwards triplex wet vacuum pump driven by a 10-h.p. Bullock motor, whose speed may be varied by means of a multiple voltage system.

The condensing apparatus for the steam turbines is a duplicate of that installed for the compound engines, with the exception of the circulating pump, which is an 8-in. centrifugal built by the Kingsford Foundry and Machine Works. Each exhaust line is provided with a 24-in. relief valve, which opens to the atmosphere. Cochrane separators are installed in the steam lines and numerous traps drain the piping, separators, and turbine steam chambers. The oil from engines is drained into a filter and then pumped by means of an automatic oiling system, to the engines, where it is fed under pressure. The turbine oiling system is independent of the engine drainage, but is essentially the same in its operation.

The greater portion of the load on generators is used in driving motors distributed all over the large brewing plant, for operating automatic malting machinery, bottling machines, elevators, fans, blowers, pumps, and for charging storage batteries used on the electric delivery truck.

This entire plant was designed and erected under the supervision of Mr. Ernest Ruebel, of Ruebel-Schwedtmann-Wells, St. Louis, consulting engineers. The De Laval turbine generators were purchased from the Turbine Engineering Company, New York City and Chicago, as agents for the De Laval Steam Turbine Company.

Engines and turbines are painted a deep red colour and are stripped with gold leaf. An automatic electric elevator is installed for the use of the attendants in going about from the condenser room, which is underneath the turbines, to the floor above, where brine-cooling coils for the refrigerating machinery are located.

SOUTH AFRICAN NOTES.

THE RECORD DIAMOND.

DR MOLLENGRAFF gives the following interesting description of the record diamond from the Premier Mine. It is a portion of a much larger stone, the original form of which can only be roughly guessed at. Four pieces of this original stone have been broken off along cleavage planes, which we know to have the position of octahedral planes. Each of these fragments must have been of considerable size. Consequently, the stone itself shows only a portion of its original natural surface (called "nyt" in the diamond-cutter's jargon), the greater portion being formed by these four flat cleavage planes. The remaining part of the surface shows one octahedral face and a curved irregular surface roughly corresponding to six faces of the dodecahedron, while one very irregular face of the hexahedron is indicated by quadrilateral impressions which are characteristic of these faces in minerals, such as the diamond, which possess the octahedral mode of growth. The stone is a single crystal, no twinning planes or twinning lamellæ being present. The stone is quite colourless, its perfect transparency being best compared to that of pure ice or of the variety of silica known as hyalite. There are a few grains (inclusions) and also some flaws or internal cleavage planes "glessen" as the diamond-cutters call them in it, but their position is such that they do not detract from the value of the stone as a gem. It is certainly the purest of all the very big stones known.

The question is raised whether there is any likelihood of finding the fragments which have been detached from this stone by cleavage. It is, of course, possible, but nobody can say whether or where they will be found in the mine. Diamonds are formed at very great depths from carbon dissolved in the molten basic igneous rock (blue ground), from which under the conditions of enormous pressure and very high temperature which prevail at these depths, the carbon crystallises out in the form of diamond. During the period of eruption the diamonds were carried to the surface with great force, and the excessive friction which must have existed in the magma during ejection through the crater pipe, caused the fragments to be cleaved from the original stone. They may have been blown out during the eruption, or they may still be in the diamond pipe, and may be unearthed at some future time.

EARLY SOUTH AFRICAN DIAMONDS.

At the present time it is interesting to glance at some of the earliest discoveries of diamonds in Cape Colony and the Transvaal. Mr. David Draper recently contributed an instructive paper on this subject to the South African Mines, Commerce and Industries, in which he cites the following from the Queenstown Representative, dated March 3rd, 1871, as showing that diamonds were found in the Transvaal at a very early date: Great excitement was caused here a few days ago by young Joubert bringing in a diamond of 4½ carats which he found on the farm of Mrs. Hennessy, about 2½ miles from here (Pretoria). The Government at once took steps, sent out a commission, Broderick, Lys, Skinner (the two former lately from the diamond fields) and their report is of such a nature that I have no doubt that in a week there will be quite a crowd at the new diggings. Piet Marais and H. Struben have taken a lease of part of the farm, and will commence operations at once. Several farmers have found diamonds on the banks of the Elands River. Two diamonds have been found at Zoutpansberg the Government has sent for them to be tested here—expected next week. In 1870 a diamond was found at Rustenburg. It was valued at £150. These finds, however, were not considered as of much account.

A DISCOVERY IN 1897.

In 1897 we find Mr. Draper notifying to the members of the Geological Society that a most interesting discovery of a diamondiferous pipe had been made lately in the vicinity of Pretoria. He had the permission of the owners to make public the fact that diamonds had been found in what appeared to be a small volcanic pipe, containing minerals closely resembling those in older known diamond mines. Garnets "carbon," olivine and other minerals associated with the diamond were there in abundance and eleven diamonds, one weighing sixteen carats, and several smaller ones had been found in washing the blue. The interesting feature regarding this find of diamonds was that it was the first undoubted diamond mine found in the Transvaal, and as it was situated in the quartzites of the Magaliesberg, it was in a geological horizon much older than the Karoo shales of Kimberley, and also than the cave stones wherein the monastery diamond mine was situated.

A CONTENTION DISPELLED.

As to the latest find, Mr. Draper remarks that the discovery of true diamond-bearing pipes of exceptional richness in the Transvaal is now an established fact. The find at the Premier diamond mine is unprecedented in the history of diamond mining in the world. In other ways, the discovery of true diamond-bearing pipes in the Transvaal has had far-reaching effects. The old theory, that diamonds were derived from the carbon extracted by heat, from the carbonaceous shales which surrouned the old craters near Kimberley, has been exploded, and the contention which every Kimberley man maintained so stoutly, "that there were no mines outside of the Kimberley and Jagersfontein areas," has been completely dispelled. Kimberley men held that no "hardbank" could exist as a surface rock, and that consequently the Schuller could not possibly be a diamond mine, but they found out that they had a good deal to learn about diamond mines. Most probably neither the largest nor the richest diamond mine has been discovered in South Africa, and the fabulous yield of the Premier should be a stimulant for further research.

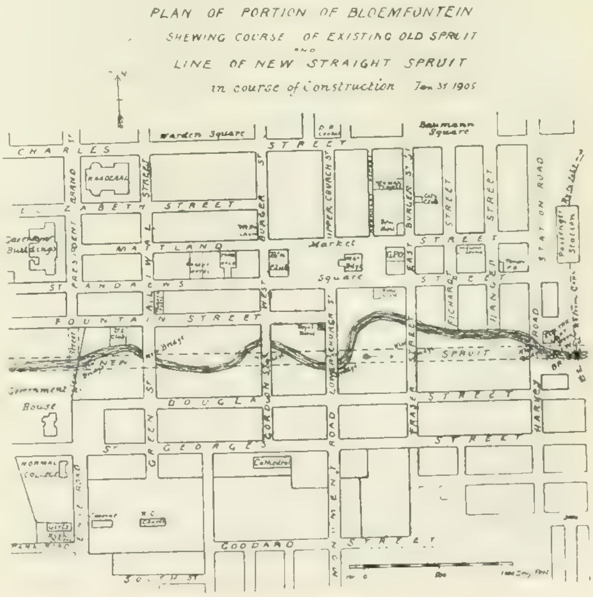
FLOOD PREVENTION AT BLOEMFONTEIN.

The disastrous flood of January 17th, 1904, will long be remembered by the inhabitants of Bloemfontein. Twenty-six persons were drowned or fatally injured; 95 dwelling houses and other buildings were wrecked or damaged to the extent of £45,000, and the destruction and damage to merchandise, stock, goods and chattels has never been calculated, even approximately. As will be seen on reference to the accompanying plan, when flood water rushed down the old spruit in a raging torrent, it had no time to follow the various sudden bends and twists in its channel, but made a straight cut from point to point with disastrous results to everything in its path.

Floods of various degrees of severity have occurred from time to time in Bloemfontein, projects were discussed for remedying the evil, but nothing was done. The flood of January 17th, 1904, however, recalled the town council and the ratepayers generally to a sense of the danger to the public weal involved in any further neglect of duty, and the council decided to excavate a new straight cut 100 ft. wide at top, 75 ft. wide at bottom, with an average depth of 15 ft., in conformity with plans and sections prepared by Mr. H. F. Peet, Assoc.M.Inst.C.E., the city engineer. The new spruit will be nearly a mile in length—the upper end is not shown on the plan—and there will be six new stone bridges in the positions shown, built of local sandstone of excellent quality. Tenders were invited in due course, the Transvaal Engineering and Contracting Company, Ltd., formerly known as Pauling Bros., being the successful competitors. They undertook to do the whole of the works, including bridges, for £54,267 5s. 5d., within twelve months from date of order to commence. The works were commenced on October 6th, 1904, and on December 31st, 1904, the contractors had already executed more than one-third of the excavation.

Strenuous efforts were made to get a straight cut through on the line of the new spruit before the rainy season commenced, of a sectional area at least equal to that of the old spruit. These efforts were happily successful. By a singular coincidence, on January 17th, 1905, there was a heavy rainfall of 1·00 in. in about one hour, but the greatest depth of water in the new cut was only 5 ft. 6 in. and no damage of any kind occurred.

To give an idea of the force of the flood of January 17th, 1904, it may be mentioned that two steel bridges each having a floor space of 40 ft. by 20 ft. were washed away bodily. The Harvey Road bridge was carried by the flood through the railway bridge and dumped about 200 ft. lower down the stream. The depth of water at the railway bridge which has a waterway of 50 ft. only, was 21 ft. 3 in. The Fraser Street bridge met with a similar fate. The engine room of the Electric Lighting Works was flooded and the city plunged into darkness for several nights. The railway bridge dammed back the water to a height of 8 ft. It is intended by the city engineer that the new railway bridge shall have a waterway of 100 ft.



TECHNICAL SOCIETY NOTES.

The paper which Professor David Capper presents to the Institution of Mechanical Engineers to-night is an important one. The "First Report to the Steam Engine Research Committee"—so the title runs—scarcely conveys an idea of the amount of work which it covers. For what has actually been achieved during the trials at King's College, one must wait until the paper has been read, but it is common knowledge that it relates to trials extending over a period of several years and it is believed that the report will be the more exhaustive and complete than any which have preceded it.

It was an interesting discourse with which Mr. William Frecheville, the newly-elected president of the Institution of Mining and Metallurgy opened his year of office yesterday. Mr. Frecheville drew on the rich storehouse of his memory and spoke of experiences in many lands and under very varied conditions. Gold and copper mining are perhaps Mr. Frecheville's strongest points, although he speaks with authority on all that appertains to mining engineering. The concluding portion of his address dealt with the aims and objects of the Institution of Mining and Metallurgy. A full report of the presidential address will appear next week. The new vice-presidents of the institution are Mr. Charles J. Alford and Mr. Edgar Taylor.

One of the most interesting papers which has been read before the Faraday Society for some time past was that on "Electric Smelting," which has been reported in the present and last issue of Page's Weekly. The contribution of M. Adolphe Minet to the discussion appears in the present issue, and Mr. B. H. Thwaite also took part in it. Mr. Thwaite's main point was that both the Keller and Héroult processes were available for the useful employment of the power producing resources of the blast furnace now mostly going to waste, and Mr. Bertram Blount insisted that it was time that steel makers in this country decided to adopt electrical methods of working for making the special steels used in the construction of cutting tools, guns, safes, and motor-cars.

Additional figures relating to the Heroult furnace were available through Mr. W. Murray Morrison, who pointed out M. Héroult had recently reduced his energy figure to 0·15 e.h.p.-years per ton of steel, starting with scrap, and to the remarkable figure of 0·0114 e.h.p.-years (equivalent to 2s. 9d. a ton), starting with molten metal; he was now constructing a 300-ton mixer and a 50-ton furnace, from which still better results were to be hoped for. He added that the Keller and Héroult seemed at present the only practicable furnaces as far as this country was concerned, and Mr. R. S. Hutton drew attention to the fact that one of the advantages of the Héroult furnace was due to the fact that it was an arc as well as a resistance furnace.

A good deal of interest was shown concerning the figure of £10 per e.h.p.-year quoted by Mr. Harbord in his paper as the probable price of power. Mr. R. L. Gamlen was of opinion that this was an excessive figure, and that the big power supply companies would have no difficulty in improving upon that. Professor Wilson agreed with Mr. Gamlen that a lower figure could be quoted. Subsequent speakers called attention with not a little bitterness to the conservative attitude of British steel makers, who would not spend a £10 note on an experiment which might put £5,000 into their pockets. This, however, is the opinion of extremists.

An interesting piece of intelligence is that relating to the proposed amalgamation of the Society of Arts and the London Institution. The want of the former has been that it has no building of its own, being simply a tenant at its house in the Adelphi. On the other hand, the London Institution possesses large freehold premises in Finsbury Circus, the only objection to which is that with the City now entirely given up to business pursuits, the geographical position is at fault. The idea underlying the amalgamation appears to be that the London Institution should dispose of its valuable freehold and that adding its funds to those of the Society of Arts, the new corporation should build a new house in the West End, or at least within reach of it; perhaps, indeed, on the site that, but for Mr. John Burns, was to have been given up to Parisian vanities.

The terms of the amalgamation are practically settled. On the Committee which is dealing with the subject, the Society of Arts is represented by, it is understood, the Lord Chief-Justice, Sir Wm. Preece, Sir Owen Roberts, Sir John Wolfe-Barry, and Sir Henry Trueman Wood; and the London Institution by Dr. W. H. S. Aubrey, Major Travers, and Messrs. F. Hovenden, C. F. J. Jennings, W. T. Shaw, and Robert W. Frazer.

TEMPERATURE EXPERIMENTS.

At the last meeting of the Institution of Electrical Engineers on March 9th, Mr. Alex Siemens (president), in the chair, Mr. E. H. Rayner submitted a paper communicated by Dr. R. T. Glazebrook, F.R.S., reporting on temperature experiments carried out at the National Physical Laboratory. The first investigation was as to the effect of heat on the electrical and mechanical properties of such insulating materials as are usually employed in electrical machinery, more especially in the construction of continuous current dynamos and transformers. The second part deals with the internal temperatures of field coils of continuous current machinery. The research in the first investigation involved the determination of the voltage which would pierce the substance, and tests devised to measure the loss of mechanical strength and brittleness. Mr. Rayner exhibited apparatus used in the experiments and gave some practical illustrations of its use.

DR. GLAZEBROOK ON RESULTS ACHIEVED.

Dr. Glazebrook said the report presented was the outcome of a combination of the resources of the National Physical Laboratory and that of the leading manufacturers who supplied the materials for testing purposes. The object of the experiments was to define as clearly as possible the manner in which the temperature rose in machines of various patterns under working conditions. The first question was the determination of the highest temperature that the materials ordinarily employed in electrical machinery could be allowed to reach, and what were the conditions those materials would be under at these high temperatures. Did the strength of the materials increase under such conditions, and if so up to what temperature? It was clear the brittleness of the materials used increased as the temperature rose, but the problem was at what point the brittleness increased to a degree which was dangerous. The mechanical tests were not difficult to devise and carry out. Mr. Rayner had explained the methods which were used in making various experiments and had stated the results.

Taking the matter quite generally it would appear that the properties of the materials tested were somewhat improved by heating up to 75 deg. C., although perhaps, the resistance to punching and brittleness was not always improved up to that temperature. Even up to a temperature of 100 deg. C., the dielectric strength of the materials improved, and the mechanical properties were not seriously affected, but at the higher temperature of 125 deg. and 130 deg. C. weakness began to manifest itself. He might point out that these results had been confirmed by a similar series of experiments undertaken by Messrs. Crompton, and as far as he had seen the results, by another series undertaken by Messrs. Siemens. The trend of all these experiments was to show that up to a temperature of 100 or 110 C., or even perhaps a little higher, the materials which were likely to be used in field coils did not in practice show any such sign of deterioration as might condemn them from use. These, however, were matters to be discussed by members of the Institution with more practical experience than himself.

COTTON AS AN INSULATOR.

One very interesting fact brought out by one of Mr. Rayner's experiments was the way in which the temperature of the cotton and all other insulated materials changed as the moisture was dried out, and there was one particularly striking point to which attention might be directed. When cotton had been treated for some appreciable time and kept at that high temperature, and then was suddenly allowed to cool, there was a very large sudden rise of resistance. Reference was made in the paper to that fact and the way in which the moisture was drawn back into the pores of the material on sudden cooling. Assuming it to be shown by the experiments detailed in the first part of the paper that such temperatures might be allowed in machines without damage, the question arose as to what temperatures were actually reached in machines at work. It was possible, of course, to measure external temperatures by thermometers, and even then large variations could be got by varying the mode of packing the thermometer. It was possible also to measure the average temperature internally by means of the change of resistance, and he thought that the very simple portable apparatus which Mr. Rayner had devised made it easy to measure such temperatures within a reasonable degree of accuracy. The measurement of the average temperature was not, however, sufficient because it was clear that the temperature at one part of the coil might exceed the average temperature by a very considerable and by a varying amount. The experiments made by Mr. Brown years before had shown that it was just a question whether sufficient variety had been made in researches of this character and it was considered that it might perhaps be advisable to repeat the experiments with a little modification on a series of coils of various sizes and pattern. He would like to refer to the valuable assistance received from the various manufacturers, the work done really being, as he had stated at the outset, a combination of the resources of the National Physical Laboratory and the manufacturing side of the industry. The coil was first tested at the laboratory to see what the distribution of temperature would be when not on the machines, and then afterwards tested in the maker's works. The work was carried out at the suggestion of the Engineering Standards Committee and the thanks of the Institution were due to that Committee for the help given. He was ready to hear suggestions as to carrying the work further.

The discussion was adjourned.

PRIME MOVERS AND MODERN POWER GENERATION.

At a meeting of the Leeds Association of Engineers, the President occupying the chair, Mr. J. T. Pullon read a paper on "Prime Movers and Modern Power Generation."

Steam engines, said the author, were the most important of our prime movers; modern improvements being not so much in the engines and boilers as in the numerous auxiliaries. Considerable economy in boiler feeding was effected by Halpin's thermal storage vessels, placed above the boiler through which the feed is passed. Unwin's test gave an economy of 20 per cent., and Mr. Ivatt had recently applied one over the barrel of a Great Northern locomotive. With colliery winding engines using 4 to 5 tons of steam per hour and rolling mill engines using 20 tons, M. Rateau had effected a great saving by collecting the exhaust steam in thermal storage vessels for use in driving low-pressure steam dynamos and working with a 25-in. or 26 in. vacuum. Further economy lay in the direction of superheating. The thermo-dynamic gain was only a small one, the index of expansion of superheated steam being 1·3 as against 1·03 for saturated steam, the work done being proportionately less and heat was necessary for superheating. The economy was therefore not directly due to superheating but to prevention of loss due to initial condensation, leakage, etc. The maximum efficiency of boilers reported up to date was 83 per cent. but was often as low as 65 per cent.

Internal combustion engines were also passed under review, Mr. Pullon alluding to the effect of Thwaite gas as compared with other gases rich in hydrogen in giving a better and larger turning moment on the crankshaft with much less strain and shock on the bearings. This was illustrated by three combined diagrams. A 400 h.p. gas cleaning plant would be at work on this system in Leeds in a few weeks.

THE TRAMWAYS AND LIGHT RAILWAYS ASSOCIATION.

The official circular for March, 1905, contains a notice of a proposed visit to the Metropolitan Electric Tramways on Thursday, March 30th; and of Mr. G. A. Trube's lectures on "Brakes." A full report of the annual meeting, on February, 10th is given, and of Mr. Herbert Jones's lecture on the Waterloo and City Railway (with diagrams), with the discussion thereon, on February 23rd. The visit to the London United Tramways is fully described. The correspondence on the limits of speed in the case of tramways with the Board of Trade, and their latest memorandum on details of construction and equipment, are also given.

* * *

The report for the year ending December 31st, 1904, of the Institution of Mining and Metallurgy, states that during the year the membership has increased by 134, the total number of members being 1,246. The report states that the council look for an early decision in regard to the reorganisation of the Royal School of Mines. A committee has been appointed with the object of standardising mining and metallurgical weights, measures, terms, etc. The income of the year at £4,135 showed an increase of £945.

* * *

At the last meeting of the Glasgow Students' Association of the Institution of Civil Engineers, Mr. J. E. Harrison, M.Inst.C.E., president of the association, presiding, Mr. Thomas Lees, jun., Stud. Inst.C.E., read a paper on "Permanent Way." He discussed the important features in the construction of permanent ways in modern railroad practice, and compared them with the methods adopted abroad. A short historical sketch was given showing how the modern railway track had developed from the old wooden tracks of earlier times. The permanent way proper was then dealt with, and the practice of British railway companies compared with American methods. In conclusion, a plea was made for supported joints in preference to suspended joints. An animated discussion followed.

NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)

GREAT BRITAIN.

THE Clyde shipbuilders are having a busy time just now, as four of the armoured cruisers of the *County* class are either ready for their trials, or have already entered upon them. The *Carnarvon* also, which has been built by Beardmore, has completed her trials and attained a full power speed of 23·3 knots, as against the 22·25 designed.

The following table gives the results of the trials:—

	At ⅕ power.	At ⅘ power.	At full power.
Speed, knots ..	14·3	21·43	23·3
I.H.P.	4,756	15,212	21,489
Revolutions ..	84·3	128·7	142·1
Steam pressure, lb. ..	184	—	202
Coal consumption, lb.	2·11	—	2·28

The *Argyll* also is in dry dock preparing for her trials, and the *Roxburgh* and *Antrim* should also shortly be at sea for the same purpose. It is expected that the *Carnarvon* will be commissioned in about six weeks' time.

Approximate dates for the launching of the *Africa* and the *Hibernia* have been announced, and from these it is likely that the *Africa* will be off the stocks towards the end of May, and the *Hibernia* on or about June 6th. These two vessels were laid down within a few days of each other and the progress made with them has therefore been at a fairly uniform rate.

FRANCE.

There is still some doubt as to the ultimate decision of the Minister of Marine on the subject of the armoured cruisers *Edgard Quinet, Ernest Renan* and *Waldeck Rousseau* (C. 17). It had been intended to make the *Edgard Quinet* a vessel of 23 knots speed and the other two of 24 knots and larger displacement. Homogeneity, however, is one of the attributes M. Thomson desires to introduce into the French navy, and for that reason he has called for estimates as to the cost of altering the *Edgard Quinet* to conform with the lines of the *Ernest Renan*. If the pecuniary loss entailed is not too heavy it is quite probable that the alterations will be effected.

GERMANY.

The discussions on the German navy estimates were a trifle acrimonious and in the end the original amount of the estimates £11,610,000 (M.232,200,000), was reduced by £159,000 (M.3,198,000). The total number of men voted was 36,622.

RUSSIA.

The fate of the three small battleships built by the Terni Trust as a speculation has now apparently been settled by the purchase of them by Russia. They cannot, of course, be delivered until the war is ended, but they will then do something to balance the *Kashima* and *Katori* which are building in this country for Japan. The fact of the sale of the three vessels (which it was once understood were for the Italian navy) has been kept very secret, and it does not appear that any official announcement of the transaction is to be expected while the war continues.

The state of Rozhdestvenski's squadron must be very bad by now, and the report that the bottoms of the vessels are so foul that they can hardly move through the water is by no means improbable. Three months lying idle in the waters around Madagascar is not the best way to keep a battle squadron up to the fighting and manœuvring efficiency required to meet an enemy like Togo.

UNITED STATES.

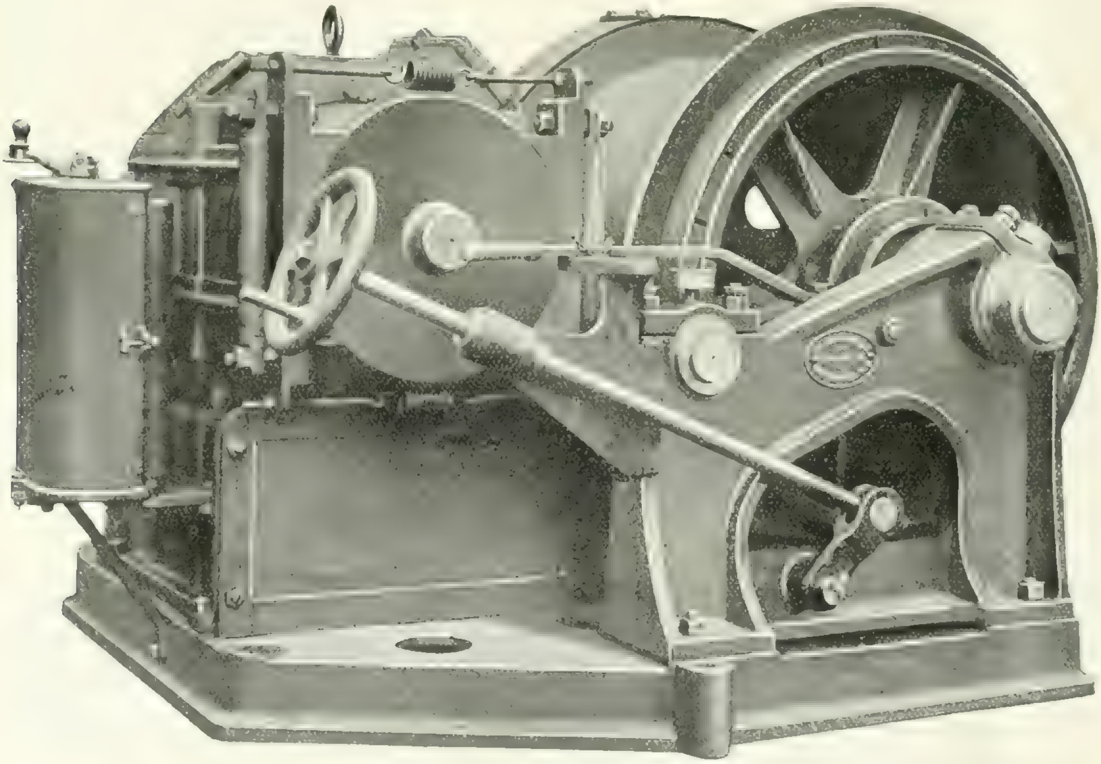
The Senate has passed the Naval Appropriation Bill practically in its entirety, and the United States programme for the ensuing year therefore comprises two battleships and some smaller vessels.

Tenders have been called for for three "scouts" of 3,750 tons displacement. The general dimensions of these vessels are: Length, 420 ft.; beam, 46½ ft.; draught, 16¾ ft. The maximum coal capacity is to be 1,250 tons and the engines are to develop 16,000 h.p., but the American papers fail to state what speed will be required. The engines will be of the ordinary reciprocating type and steam will be supplied by twelve boilers of the *Express* type.

AN ELECTRIC HAULING WINCH.

By Messrs. Chambers, Scott and Company, Motherwell, N.B.

THE accompanying illustration represents the latest type of electric hauling winch for outside service manufactured by Messrs. Chambers, Scott and Company, of Motherwell, N.B. It is of compact design, and strong construction, and is arranged so as to permit of easy overhauling when necessary. The gear is powerful, exerting a pull of two tons on the winding rope at a speed of 120 ft. per minute. A magnetic and mechanical brake and clutch gear are fitted to the winch. This arrangement allows the gear when winding to be braked automatically as required, and enables the load to be run out under perfect control of the screw brake, all the levers, etc., being conveniently arranged for the operator at the rear of the winch. The drum is 3 ft. in diameter, built of steel with cast-iron flanges, and runs loosely on its shaft, to which it can be fixed by means of a clutch actuated by a hand lever. It is equipped with a wood-lined brake, operated by screw and handwheel, and the gear is of cast steel, the first reduction gear being machine-cut. The motor is of the enclosed type, fitted with a self-sustaining magnetic brake and raw-hide pinion, and is controlled by a reversing and speed-regulating switch of the tramway type, furnished with a metallic resistance in a cast-iron box forming a seat for the motor. The gearing is protected by built steel covers and guards, whilst the electrical equipment is all encased. All the gear, etc., is mounted on a sole plate, and the bearings are fitted with gun-metal bushes and adjustable covers and lubricators. The winch illustrated, which has been supplied to a large shipbuilding yard, will haul trucks loaded to sixty tons at the rate of two miles an hour on a level track.



NEW ELECTRIC HAULING-WINCH FOR OUTSIDE SERVICE.

HEAVY EXPRESS LOCOMOTIVE DESIGN.

By J. R. Bazin.

ONE of the chief points to be aimed at in designing a locomotive for working heavy express trains is to plan it in such a manner that its power can be exerted uniformly throughout the journey; that is to say, its speed, when once fairly started with its train, should never fall below 53 miles per hour when ascending banks, and rarely exceed 70 miles per hour in running down hill.

TWO PREVALENT TYPES.

The two classes which are becoming most prevalent are the "10 wheel" and the "Atlantic" type. Comparing the "10 wheel" type with the "Atlantic" type, the former is unquestionably better adapted for working over a road with many steep gradients on account of its greater adhesive power, but the third-coupled axle undoubtedly must hinder the running of the engine at high speeds, causing a great deal of extra wear and tear to the machine and increasing the internal resistance; and it is very doubtful whether the extra seventeen tons or so available for adhesion is really an advantage with the size of cylinders found to be the most satisfactory for such engines when employed on straightforward express work. The "Atlantic" type possesses one distinct advantage over the "10 wheel" type, as it has all the coupled axles placed in front of the firebox, and so enables the firebox to overlap the frames, thus allowing it to be made as wide as the loading gauge will permit, and increasing the grate area to a large extent; and instead of having a long narrow box, a short broad box can be employed, giving greater facilities for firing, also enabling a larger water-space to be left between the inside box and outside shell, a most important feature in boiler design, which not only allows of freer circulation, but also gives greater facilities for getting the scale and dirt out of the boiler. In this type of engine there is far greater scope for increasing the size of the firebox than is possible in any other design where the firebox has to be between the frame.

It has been stated above that the capacity of the boiler as a steam generator is the real source of reserve energy in the locomotive, and it is chiefly on account of the facilities offered for increasing the size of the boiler that the "Atlantic" type has been shown as preferable for main line work; but other important features which play equally as great a part in producing an efficient engine must not be overlooked, viz., the number, arrangement, and size of the cylinders, the diameter of the driving wheels, and the working pressure of the boiler.

DIVIDING THE ENGINE.

It is impossible to allude to the number and arrangement of the cylinders without touching on the much-disputed question of the advisability of compounding; and it may here be safely stated, as far as this country and America are concerned, that whatever has been achieved by the compound locomotive has been done by the simple engine. With the compound engine, when working hard, the most effective point of cut off in the high pressure cylinders is about 55 per cent. of the stroke, whereas in the simple engine steam is cut off at 25 per cent.; thus it is doubtful whether the amount of steam used in the compound is much less than that used in a simple engine of equivalent cylinder power. It is not intended here to discuss the various kinds of compound locomotives in use, but it is sufficient to say that the four-cylinder de Glehn engine has proved by far the most satisfactory of modern compounds. The success of the compound engine being chiefly due to its high boiler pressure, and since the use of such high pressures entails so many drawbacks, it is well to consider if the advantages claimed for compounding are really worth the extra wear and tear that the boiler is subjected to. With regard to the advisability of dividing the engine, that is a point which suggests a great opening for development in the steam locomotive; for since the objections to compounding have been briefly stated, there is no reason to prevent the system of dividing the engine being carried out in the simple locomotive. In such a design, as large a boiler as possible with the most efficient steam generating capacity would have to be provided, for which the "Atlantic" engine adapts itself admirably; and instead of using a high working pressure of about 225 lb. per square inch, as in the case of the compounds, a lower pressure of 180 lb. per square inch would give most satisfactory results.

In the case where four cylinders were employed, one pair would be placed outside and the other pair inside the frames, and could be arranged in two ways—either all driving on the front-coupled axle with the four cranks at right angles so that those of the inside and outside cylinders on the same side would be at 180 deg., thus making the reciprocating parts balance each other; or the two inside the frames could drive the front-coupled axle, and the other two outside the frames could drive on the rear coupled-axle. This latter method would perhaps distribute more evenly the stresses and strains without altering the balancing if the cranks were arranged as above.

If three cylinders were used, the most satisfactory method of placing them would be for one to be inside and two outside the frames, all driving on the leading coupled axle with the cranks at 120 deg. This arrangement would give a better turning moment than the four-cylinder method, and allow the engine to start easier, but the balancing would not be so well maintained.

SIZE OF CYLINDERS.

The next point to be decided is that of the best size of cylinders to be employed, and on examining the various types of express engines running at the present time it is found impossible to lay down a definite rule with regard to this point, as it is found that while some engineers employ cylinders up to 20 in. and 21 in. in diameter, others use 18 in. and 19 in. cylinders on similar work, with apparently equal success.

Passing from the question of the diameter of the cylinders, the part the stroke plays is of equal importance. Now the shorter the stroke the lower the piston speed and the less the back-pressure, but the longer the stroke the more room there is for the expansion of the steam and the greater the amount of leverage on the crank-shaft; but with a long stroke the back pressure to be overcome amounts to a considerable factor in increasing the internal resistance of the engine at high speeds, and it is found in practice that it is better to use a stroke of moderate length, say 24 in. or 26 in., and give the cylinder an extra ½ in. or 1 in. diameter to allow for better expansion, than to use a long stroke and small diameter of cylinder or a short stroke and large diameter of cylinder. It may be suggested that two cylinders 19 in. by 24 in. could be employed with satisfaction where the total weight on the coupled axles must not exceed 36 tons, of which, under the most favourable circumstances, rarely more than one-fourth would be available for haulage purposes; and both the steam and exhaust ways should be of ample dimensions to allow as great a head of steam to enter the cylinders as possible, and also to be got rid of quickly after having done its work. If, now, those two cylinders be split into four smaller ones, in order to obtain the same piston area as that given by the two 19 in. cylinders, he size of the smaller ones must be about 13½ in. in diameter; but since, with well-designed steam and exhaust ports, the total back-pressure could be reduced, four cylinders of 14 in. diameter could be employed, the stroke of 24 in. remaining the same.

With regard to the diameter of the driving wheels, in ordinary practice the most satisfactory diameter for driving wheels is found to be about 6 ft. 8 in. for fast work, and this size easily allows a boiler of large diameter to be placed above them without necessitating an extremely high centre line.

Having now described that part of the machine which converts the "heat energy" into "mechanical energy," it will be as well to say a few words with regard to the size of the steam generator or boiler for use on such a locomotive. It is in the efficiency of the boiler to generate sufficient steam to keep four such cylinders fully supplied under the most adverse circumstances that the real reserve power of such an engine is found. A boiler for this purpose should possess at least 2,500 square feet of efficient heating surface, of which quite 170 square feet should be given by the firebox, and the grate area should be about 32 square feet. Such a boiler must be at least 5 ft. 6 in. internal diameter, and about 16 ft. in length. This will give room for quite 250 tubes, having an internal diameter of 2¼ in., so as to allow for a relatively slow velocity being imparted to the gases issuing through them from the firebox, thus allowing more heat to be given out by them; also to prevent the possibility of choking taking place. A properly designed boiler of this description should be able to fulfil all that is required of it when working the heavy express trains of the present day.

"ATLANTIC" TYPE BEST FULFILS REQUIREMENTS.

It will thus be seen that the design of engine best suited for dealing with these heavy long-distance express trains is undoubtedly one of the "Atlantic" type having four h.p. cylinders, 14 in. in diameter, with a 24 in. stroke, each pair driving on two separate coupled axles, with driving wheels 6 ft. 8 in. in diameter, and these cylinders supplied with steam from such a boiler as has just been described above, working at a pressure of 180 lb. per square inch. A four-cylinder engine such as this would, in the first place, cost more than a similar two-cylinder engine, but since the wear and tear would be considerably reduced, on account of the better balancing and more even distribution of the stresses and strains, the cost of maintenance and running expenses would be less.

From a paper read on March 13th to the Graduates Association of the Institution of Mechanical Engineers

THE UGANDA RAILWAY.

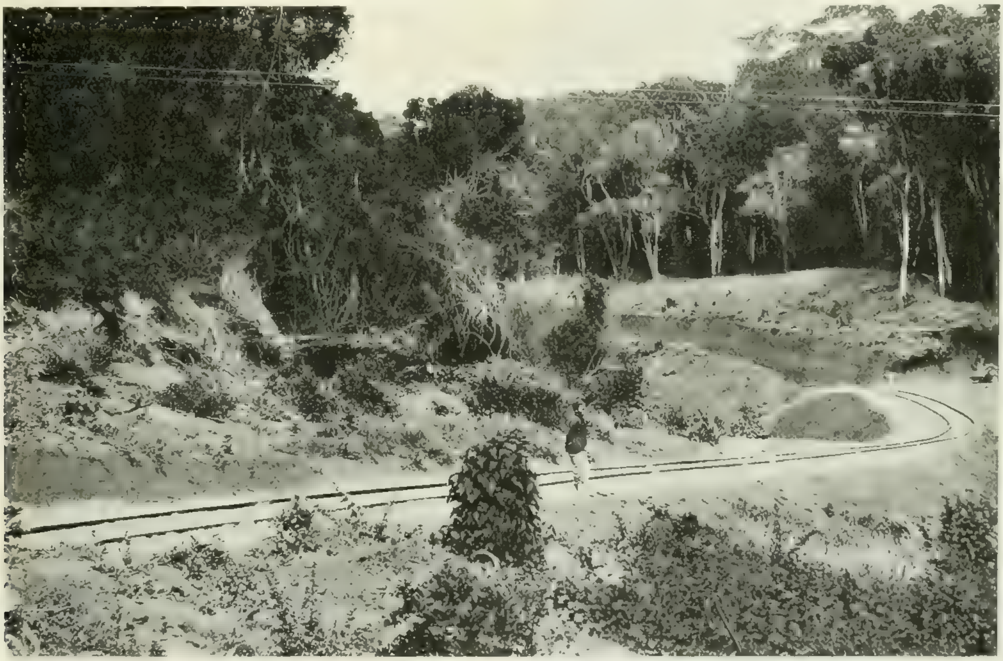
By J. D. F. Leyland.

(*Continued from page 468.*)

IN addition to the engineering difficulties there were in East Africa many extraneous ones, which may be said to be peculiar to this railway, and few of which were or could have been forseen at the outset.

Sir Guilford Molesworth, in his report, said: "This combination of difficulties is, I think, quite unique in the whole history of railway construction." The making of this railway, on account of no local labour being obtained, involved an organisation equal to the maintenance of an alien army, amounting to about 22,000 men, who had to be sheltered and fed in a practically waterless country, devoid of all resources and all means of animal and wheeled transport, native porters being used for this purpose. Everything had to be ordered a long time beforehand, requiring a great deal of foresight. Fever and "jiggers" infested the coolie camps. The water in the country, as I have said, is very scarce and unwholesome, and it was found necessary to erect large condensing plant at Kilindini, and most of the water required for consumption and boiler work had to be carried by rail from this place. About 120 tons were required per diem for drinking purposes alone.

The first 250 miles of the railway are infested with the tsetse fly, which makes it impossible for transport animals to live in this region. The progress of the work was seriously impeded by man-eating lions, which made it necessary



VIEW AT MILE 485 (TEMPORARY LINE) ILLUSTRATING THE DIFFICULT NATURE OF THE COUNTRY TRAVERSED.

PANORAMIC VIEW OF THE RAILWAY BETWEEN MUHORONI AND KIBIGORI.

to convey all the workmen back to a safe camp every night. No less than twenty-eight coolies, one engineer, and an assistant police superintendent were killed by these savage beasts.

The engineering strike in England seriously impeded work out there, causing innumerable delays in the delivery of materials required for the railway. A police force of two hundred men had to be organised and maintained. An agency for the supply of labour and materials had to be founded and kept up in India. A regular postal and telegraph service had to be established, and very complete hospital arrangements were required. The want of rolling stock and locomotives was the most formidable obstacle to progress. Every train had to carry special water-tank wagons for the use of locomotives, thus limiting its carrying capacity. Officers had to learn two native languages in use on the line.

There were, however, many advantageous conditions which, to a certain extent, counteracted the difficulties. At the river Athi, mile 310, there was found to be a supply of water enough for locomotive purposes. Also at Nairobi, and at the head of the rope incline, there was a good supply of water. Transport animals do well beyond the fly district. Traction engines of military type also proved very useful. The Wa-Kikuyu were induced to clear the jungle in their own districts. The death rate among the coolies was, on an average, 20 per thousand per annum, which, considering the climate and conditions, was remarkably low. The coolie labour obtained from India was fairly good, but very expensive. After passing mile 33, bad nights, such as have to be endured on the tropical coasts of Africa and India, are never experienced. Hospitals were established at Kilindini, Voi, and Makindu, with five medical officers to each.

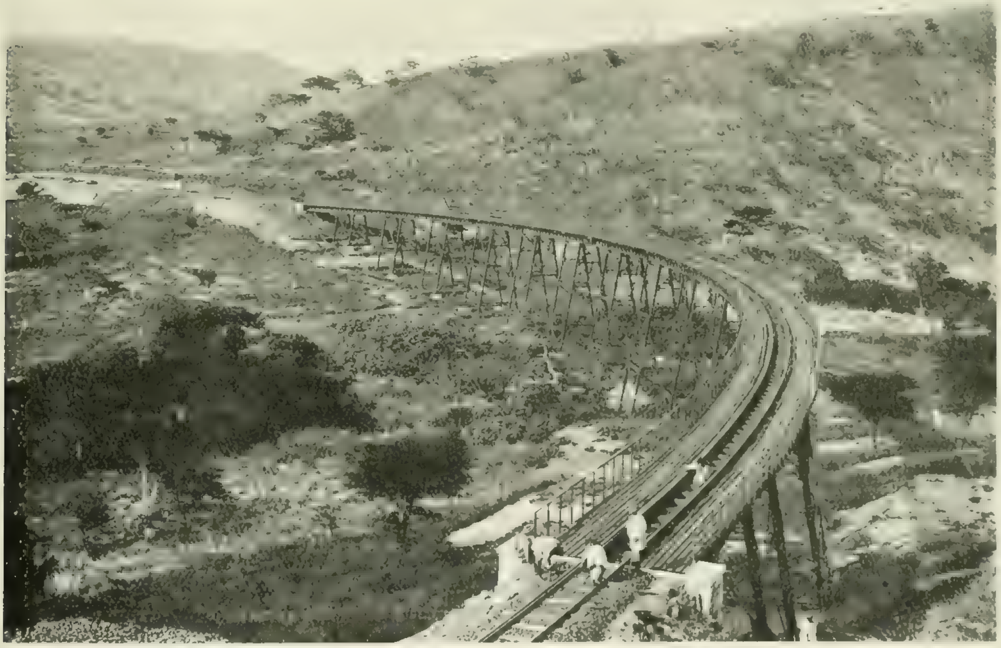
SOME ENGINEERING DETAILS.

The engineering staff was very carefully selected from a large number of candidates; all of them were extremely intelligent, energetic, and with a keen interest in their professional duties. Sir George Whitehouse is a well-known engineer, with long and varied experience in tropical countries, and he has proved his qualities by the great work he has accomplished. The Uganda Railway is a metre-gauge line. A great part of its length is through cuttings and on embankments, with steep gradients and sharp curves. There are about 500 miles of gradient and 150 miles of curves. The whole of the railway is ballasted, but it was thought at first that this would not be necessary throughout its length. The permanent way consists of 50 lb. flat-footed steel rails, carried on pressed steel trough sleepers. On all curves of less than 1,200 ft. radius, ⅝ in. extra gauge is given. The earthworks and bridging on the whole line were completed during last year.

There are thirty-five viaducts, varying in length from 117 ft. to 881 ft., and in depth from 37 ft. to 111 ft. Each viaduct is divided up into spans of 40 ft. and 20 ft., and they are built upon the spider-bridge system. Thirteen firms, three of which were American, tendered for the supply of certain of these viaducts. The contract was given to the American Bridge Company of New York, otherwise known as the Pencoyd Iron Company. This Company contracted to deliver the bridges at any British port at £10 6s. per ton, free on board, or to erect them within forty-six weeks of contract at £18 per ton. The principal workshops and running sheds are at Nairobi; the stores at Kilindini. Engine sheds have been built at Kilindini, Voi, Makindu, Nakuro, Mnara, and Port Florence.

The special conditions prevailing on the railway during construction, added to the necessity of having a large number of locomotives, have been referred to. The total number of engines on the line was about one hundred. The causes of the great number required were the steep gradients, sharp curves, the carrying permanent way material and water, and the great percentage of engines always under repair, or being washed out, which was necessary on account of the character of the water.

The accompanying illustrations are reproduced by the courtesy of the Foreign Office. (*To be continued.*)



VIADUCT AT MILE 531 ON THE UGANDA LINE.

MODERN COMMERCIAL GRINDING.

A PAPER on this subject was read before the Birmingham Association of Mechanical Engineers the following being an abstract.

The author refers chiefly to plain or taper cylindrical work, as he is of opinion that at the present time it offers more possibilities to the mechanical world than other work for which the grindery machine is used.

The early application of grinding was done chiefly on work which had been previously hardened, and could not be corrected, or brought to size by any other means, and was looked upon as an expensive refinement; but during the last few years the art has so progressed that to-day it is not possible to bring cylindrical pieces to size by any other known method so quickly, and at the same time so accurately, as with the plain cylindrical "Grinding Machine."

Another feature has been the accompanying progress of the manufacture of emery wheels, the machines being but the means of using the emery wheels. It is now known too, that work cannot be ground economically without a copious and constant supply of water.

THE SPEED OF TRAVERSE.

The author deals with the speed of traverse. It is obvious that the capacity of a grinding machine is limited by the width of the emery-wheel face, and if this is kept flat, the maximum output is being obtained from the machine. A large diameter emery wheel will retain its size or wear away less of its diameter than a small one, but if proper attention is paid to the periphery speed of the wheel the difference in size makes so very little difference in time that it can hardly be taken notice of compared with the traverse and speed of the work.

It was formerly considered that only slim work required steadying, and that heavy work, say 6 in. to 12 in. diameter, would resist both the pressure and vibrations set up by the emery wheel. This, in the author's opinion, is a grave mistake, and he seeks to demonstrate that it is in the heavy work where the rest is more essential. This, no doubt, sounds rather revolutionary until an explanation of the phenomena is given. Large pieces of work do not absorb the vibrations so quickly as small diameters, therefore they vibrate longer.

It is possible to grind large work truly circular, and with a good finish, without steady rests; but to be able to accomplish a good result, the work must be first turned true as to roundness and parallel and to within 4 or 5 1/1000 in. of the finished size. Nothing but the very lightest cut is possible with the emery wheel under these conditions, therefore the time occupied in working is greater than the present-day manufacturing conditions render desirable.

TURNED WORK NOT SO TRUE AS GROUND WORK.

No work, however carefully turned in the lathe, is so true as ground work, owing to the work in the lathe revolving upon a running centre, and any inaccuracy of revolution, either from the lathe spindle, or from the point of the centres, is multiplied on the work. With the grinding machine this defect is avoided by revolving the work upon centres which do not move, this being considered the best method of securing accuracy. To ensure work being ground concentric steady rests should never be brought to bear on parts which are not being ground, or have not been ground, no matter how apparently true the prepared parts are. To use the grinding machine successfully, one must understand that not only the machine, but the wheel and the work itself have their own part to play, and lack of attention to the two latter factors may cause trouble for which the machine is in no way responsible. The preliminary to successful grinding is a careful study of particular requirements. The wheel best suited for one class of steel would not work successfully on steel of a different carbon. Cast iron of various qualities, and bronze also, require varying treatment. Copper and bronze should be ground with a soft bonded wheel which is also used on such materials as chilled iron hardened steel, cast iron, etc. More heat is often generated on the work than can be radiated equally, thus causing it to run in an eccentric.

To overcome the trouble it is necessary to remove the cause, and if by turning on the water to its extreme limit the trouble does not cease, then a wheel with a softer bond must be tried.

To get good results from an emery wheel it must have a constant periphery speed. The importance of this fact is recognised by the makers of grinding machines, and is provided for by cone pulleys of varying diameters.

The best authorities recognise a periphery speed of 6,000 ft. per minute as being the most desirable. The ideal drive for the grinder is an electric motor, with a machine specially designed to take it; this does away with the trouble experienced by varying loads, and ample power can always be provided.

STRUCTURAL STEEL FOR MARINE BOILERS.

THE latest specification to hand from the Engineering Standards Committee is concerned with structural steel for marine boilers, and is based upon a careful comparison of the present specifications of the Admiralty, the Board of Trade, and the three leading registry societies. The sub-committee dealing with this matter consisted of Mr. Archibald Denny, chairman, Sir John Durston, K.C.B., R.N., Messrs. R. J. Butler, C.B., W. E. Smith, C.B., and P. Samson, Professor W. C. Unwin, Messrs. James Dunn, W. J. Pratten and Arthur Cooper, A. McA. Kennedy, Alexander Gracie, Henry Withy, Summers Hunter, David Colville, F. W. Dick, A. D. Wedgwood, Bernard A. Firth, H. J. Cornish, J. T. Milton, J. Foster King and John Gravell, Sir Benjamin Hingley, Bart., Messrs. William Thackray, William Wylie, J. McIntyre and James McKechnie.

The specification provides that structural steel for marine boilers must be made by the open hearth process, acid or basic, as may be specified, and as approved by the inspecting body. The finished material is to be free from cracks, surface flaws, and lamination. It must also have a workmanlike finish, and must not have been hammer dressed.

Tensile strength and ductility are to be determined from standard test pieces cut lengthwise or crosswise from the rolled material. When material is annealed or otherwise treated before dispatch, the test pieces are to be similarly and simultaneously treated with the material before testing. As regards plates, wherever practicable, the rolled surfaces shall be retained on two opposite sides of the test piece. The elongation is to be measured on a standard test piece having a gauge length of 8 in.

For material more than ·875 in. in thickness the width of the test piece between the gauge points must not exceed 1½ in.; for material ·875 in. to ·375 in. in thickness, inclusive, the width is not to exceed 2 in.; for material less than ·375 in. in thickness the width must not be more than 2½ in. In other respects the test pieces is to conform generally to the standard test piece A reproduced herewith.

For round bars the test piece must have a gauge length of not less than eight times the diameter, and a sectional area of not less than ½ square inch. When enlarged ends are used the length of the parallel portion must be not less than nine times the reduced diameter.

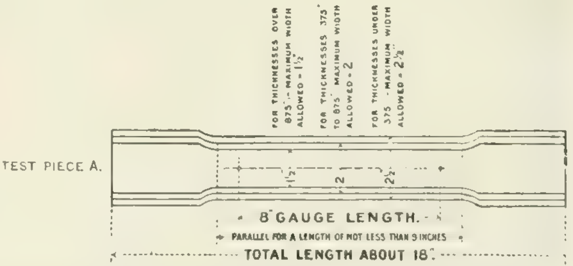
The tensile breaking strength of steel plates for shells and girders, determined from standard test pieces, are to be between the limits of 28 and 32 tons per square inch. For plates intended for flanging or welding, and for combustion chambers and furnaces, the tensile breaking strength must be between the limits of 26 and 30 tons per square inch. In the case of material for purposes in which tensile strength is not important, the tensile test may be dispensed with and the bend test only made, if so specified and approved. The elongation, measured on a standard test piece having a gauge length of 8 in., is to be not less than 20 per cent. for material of ·375 in. in thickness and upwards required to have a tensile breaking strength of 28 to 32 tons per square inch; and not less than 23 per cent. for material of ·375 in. in thickness and upwards required to have a tensile breaking strength of 26 to 30 tons per square inch.

The tensile breaking strength of longitudinal stays and angle and tee bars is to be between the limits of 28 and 32 tons per square inch, with an elongation of not less than 20 per cent. measured on the standard test piece. For bars for combustion chamber stays the tensile breaking strength shall be between 26 and 30 tons per square inch, with an elongation of not less than 23 per cent. measured on the standard test piece.

For material under ·375 in. in thickness the elongation may not be more than 3 per cent. below the above-named elongations. The tensile breaking strength of rivet bars are to be between the limits of 26 and 30 tons per square inch of section, with an elongation of not less than 25 per cent. measured on the standard test piece.

TEST PIECE A.

FOR PLATES AND OTHER STRUCTURAL MATERIAL.


FOR THICKNESSES OVER ·875" - MAXIMUM WIDTH ALLOWED = 1½"
FOR THICKNESSES ·375" TO ·875" MAXIMUM WIDTH ALLOWED = 2
FOR THICKNESSES UNDER ·375 - MAXIMUM WIDTH ALLOWED = 2½"
TEST PIECE A.
1½
2
2½
8" GAUGE LENGTH.
PARALLEL FOR A LENGTH OF NOT LESS THAN 9 INCHES
TOTAL LENGTH ABOUT 18".

Note.—It will be observed that the widths given above, being maxima, do not exclude the use of the usual 1½ in. × 8 in. test piece.

OUR WEEKLY BIOGRAPHY.

Photo by Elliott and Fry.

MR. JOHN MATHIESON,

GENERAL MANAGER OF THE MIDLAND RAILWAY.

FEW men have acquired a wider experience of railway affairs or a more comprehensive knowledge of the abstruse details of freight and passenger traffic than Mr. John Mathieson. Born in 1846 at New Cumnock in Ayrshire, he commenced his exceptionally active railway career at the early age of thirteen, when he entered the service of the Glasgow and

South-Western Railway at the station of his native village. His aptitude for business soon met with the approval of his superiors, and after he had spent about eighteen months at New Cumnock station he was transferred to Hurlford, which at that period was the most important mineral centre on the company's line. He spent several years here in the capacity of booking-clerk, and whatever leisure hours were at his disposal he diligently devoted to the study of railway economics.

The authorities were not long in discovering that in young Mathieson they had a servant whose mental equipment fitted him for a higher position, and in 1865 he was promoted to be station-master of Stewarton. He held this post for a few years, when he was singled out for further distinction, and was selected to fill a vacancy in the office of the superintendent of the line. He passed through the various grades, and in 1875, when he was twenty-nine years of age, he was made head of the department.

In 1889 Mr. Mathieson was invited by the late Sir Thomas McIlwraith to go to Queensland as chief of the Commissioners of the State railways of that colony. The offer, which he naturally accepted, was a tempting one, carrying an annual emolument of £3,000.

At the end of his first year's administration in Queensland the capital invested in the railways was £13,606,384. By the end of June 1895 it had increased by new construction to £16,522,293. During the time Mr. Mathieson was responsible for the management the Queensland railways reached a degree of efficiency, combined with economy of maintenance, which they had previously never obtained. The gross earnings rose from £849,868 to £1,025,512, while the working expenses were reduced from £618,798 to £581,973, showing an increase in the net earnings from £231,070 to £443,539. Yet despite all that was accomplished to bring about economical working, Mr. Mathieson retained the high esteem of his staff, from whom he always seems to have a faculty of securing excellent service.

The conspicuous ability displayed by Mr. Mathieson as Commissioner of Queensland met with universal admiration, especially in Victoria, where railway progress was hampered by political control, and the absolute necessity was felt for entrusting the management of the Victorian railways to a strong-minded man, capable of independent action, with a perfect freedom from political bias. The Ministry had keenly observed the unretarded progress of the Queensland system, for which Mr. Mathieson was responsible, they therefore decided to invite him to become Commissioner of the railways of Victoria. In April, 1896, the Minister of Customs opened negotiations with Mr. Mathieson, which resulted in his accepting their offer at an enhanced salary of £3,500 per annum.

At the outset he had to face a deficiency on the annual working of about half a million sterling. In order to effect a substantial reduction drastic reforms were begun immediately he assumed the reins of office; rates and fares were revised, and a thorough reorganisation of every department was carried out. Under his administration the revenue of the railways increased by £623,770. This result was not achieved by a curtailment of the working expenses, for apart from pensions and gratuities, the concessions granted to the staff since 1895–6 aggregated £190,000.

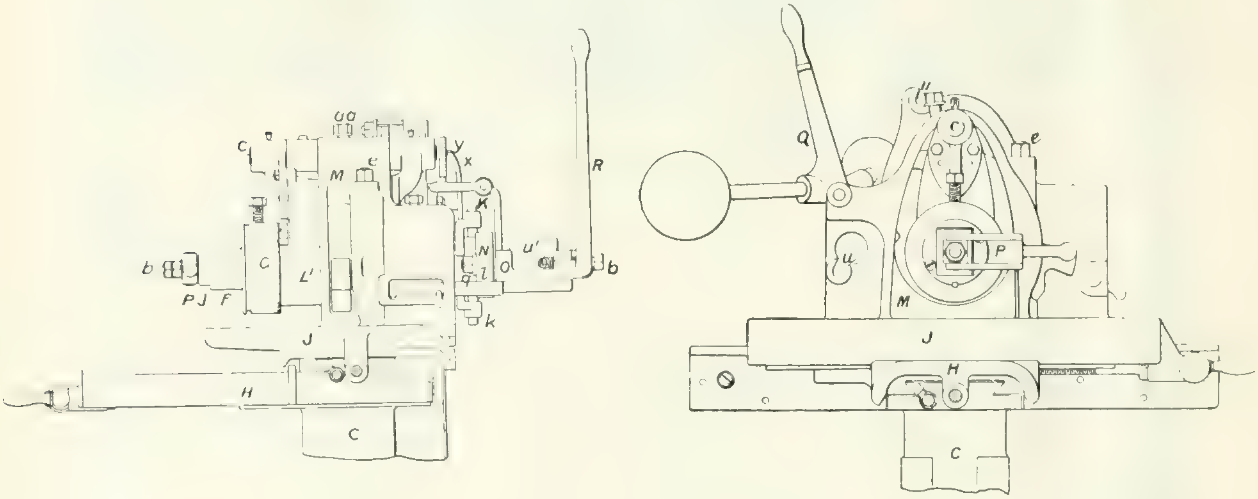
On the resignation of Mr. George H. Turner the Directors of the Midland Railway Company resolved to offer his position to Mr. Mathieson, and in July, 1901, he entered upon his present appointment as general manager of the company. Under his direction many improvements have been introduced and greater facilities afforded to travellers, while the strengthening of the alliance between his company and the one with which he graduated is mainly due to his influence.

"TOOLS FOR ENGINEERS AND WOOD WORKERS."

OF the making of books on this subject there is no end. The great and growing importance of cutting tools in modern practice, and the developments which are constantly taking place in this department of mechanical engineering, have, perhaps, made the multiplication of books inevitable. It is clear, in the first place, that treatises on a subject which is still in a condition of active evolution rapidly become—not obsolete, perhaps—but at all events out of date, while the multitudinous character of the problems to be dealt with is driving authors to specialise rather than make vain attempts to cover the whole field. If Mr. Horner has added measuring instruments to his main subject it is because tools and measuring instruments cannot be separately regarded in shop practice, and this, at least, the critic must concede, that he has treated the subject of instruments of measuring very fully, and has illustrated them to advantage. For the rest, the book is likely to prove useful enough, although the author might very well have sacrificed something of the history of the subject and told us even more than he has of modern practice.

In his opening chapter the author traces the effects of the substitution of the machine-operated tool for the hand-tool producing the interchangeable method of manufacture, a system, as readers are aware, initiated in France and subsequently developed to a high state of perfection in the United States. The introduction of high speed steels in 1900 was a starting-point for new developments, the character of which may be gauged by the amount of space devoted to the subject in the pages of the technical press.

In dealing with tool angles in his introductory remarks, the author takes occasion to point out that the secret of heavy cutting must be credited to lubrication and tool support equally with tool angles, and he is properly insistent upon the importance of discriminate lubrication.



FIGS. 1 AND 2. NO. 1 TOOL GRINDING MACHINE BY MESSRS. WILLIAM SELLERS, AND COY.

The first section of the book is devoted to the "chisel group"—tools used by woodworkers, planes, hand chisels for metal working, and tools for cutting metal, shearing tools and the like. Much of this is familiar matter enough, and is, perhaps, part of the author's plan of being comprehensive within the limits he has marked out. Section II. deals with scraping tools, Mr. Horner being careful to draw a definite distinction between the scrape and the cutting tool. In the third section of the book, an important branch of the subject, that of tools allied to both chisels and scrapes, is treated at some length. Of the vexed questions surrounding saws the author writes fully, with a lofty disregard of the pitfalls which beset the treatment of a subject admitting of so much discussion and difference of opinion. Milling cutters, boring tools, taps and discs, punches and hammers, are discussed in the sequence named. The chapters dealing with these subjects are excellent in their way, but it may be suggested that Mr. Horner might have presupposed some elementary knowledge on the part of the reader of the matters treated.

For the most part, however, it is possible to commend the author's treatment of his subject, and the book is certainly well illustrated, which is always a merit in a work of this kind. From the chapter on tool grinding and sharpening, we reproduce illustrations of the William Sellers No. 1 tool-grinding machine.

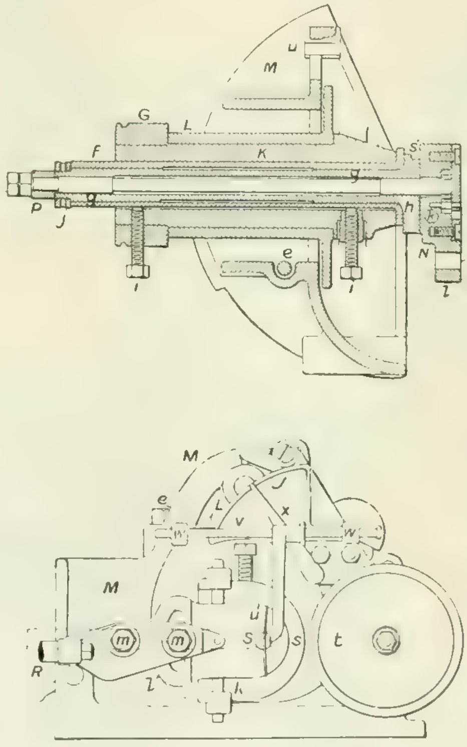
In the Sellers' machines there are two designs embodied, one the larger size in which a wheel is used having two grinding edges of Vee shape, the two meeting at an angle of 90 deg.; the smaller machine having a wheel of ordinary disc shape.

It is a universal machine covering all the tools used in a shop on lathes, planers, shapers, slotters, etc., and taking tools, the shanks of which do not exceed 2½ in. by 2 in. in cross section. The machine is self-contained and there are two chucks, one for grinding straight-faced tools, the other for those having curved faces, and a device for grinding formers.

The case of straight-faced tools, or those the cutting edges of which are produced by the intersection of plane surfaces, is dealt with by the sliding movements, and circular adjustments just enumerated. K (fig. 3) is the chuck used for these, fitting and revolvable with the bearing L. The case of curved-nosed tools involves more elaborate mechanism. Messrs. Sellers have prepared charts giving the most approved angles and clearances for various cutting tools, together with particulars of what formers should be used and position of index finger to be set.

As intimated at the outset measurement problems are discussed at some length. The author rightly insists on the necessity for a uniform international standard of measurement, which, indeed, since the spread of the interchangeable system, has become a practical necessity. Measuring instruments must be adapted to the work, of course; in some instances $\frac{1}{100}$ of an inch approximation is enough; in others $\frac{1}{1000}$ of an inch too little, and in the modern system the degree of accuracy called for in particular cases is predetermined. Modes of measurement are fully discussed, and the gradual change in the practice of modern shops, the result of the invasion of the gauges, is clearly traced. Although as intimated above not a little of Mr. Horner's matter is superfluous, the work has a good deal of value as a summary of knowledge on the subjects with which it deals, and it will, no doubt, find a ready audience.

The author has dispensed with an appendix, and it will occur to the reader who has tested the references that a little more space might with advantage have been devoted to the index.



FIGS. 3 AND 4. SHOWING MECHANISM EMPLOYED IN THE SELLERS MACHINE FOR GRINDING STRAIGHT-FACED AND CURVED-NOSED TOOLS RESPECTIVELY.

"Tools for Engineers and Woodworkers, including Modern Instruments of Measurement," by Joseph Horner, A.M.I.Mech. E. With numerous illustrations. Crosby, Lockwood and Co.

RECENT DEVELOPMENTS IN ELECTRIC SMELTING.

THE FROGES-HÉROULT PROCESS.

By Adolphe Minet.

(*Continued from page* 511.)

Of all modern industries the electrometallurgy of iron has, perhaps the greatest future, and the paper by Mr. Harbord, an abstract of which appears in the last issue of Page's Weekly will suffice to show what great interest the subject possesses. His report forms a noteworthy addition to the history of the electrometallurgy of iron. I have been struck by a fact of considerable importance; namely, that one of the proposed methods allows of the complete elimination of sulphur and phosphorus from the materials worked upon. The Froges-Héroult process, to which I allude, has been tested in practice, for by it has been produced 3,000 tons of steel, and the Société de Froges has been placing this steel on the market for the last two years.

This furnace was originally used at Froges for the production of aluminium and its alloys, and later for the manufacture of artificial corundum and calcium carbide. It was afterwards employed for the production of ferro-chrome, ferro-silicon, and ferro-tungsten, at the suggestion of M. Charles Combes.

All these operations have been greatly developed within the last few years at La Praz, at the works of the Société Electrometallurgique Française. The

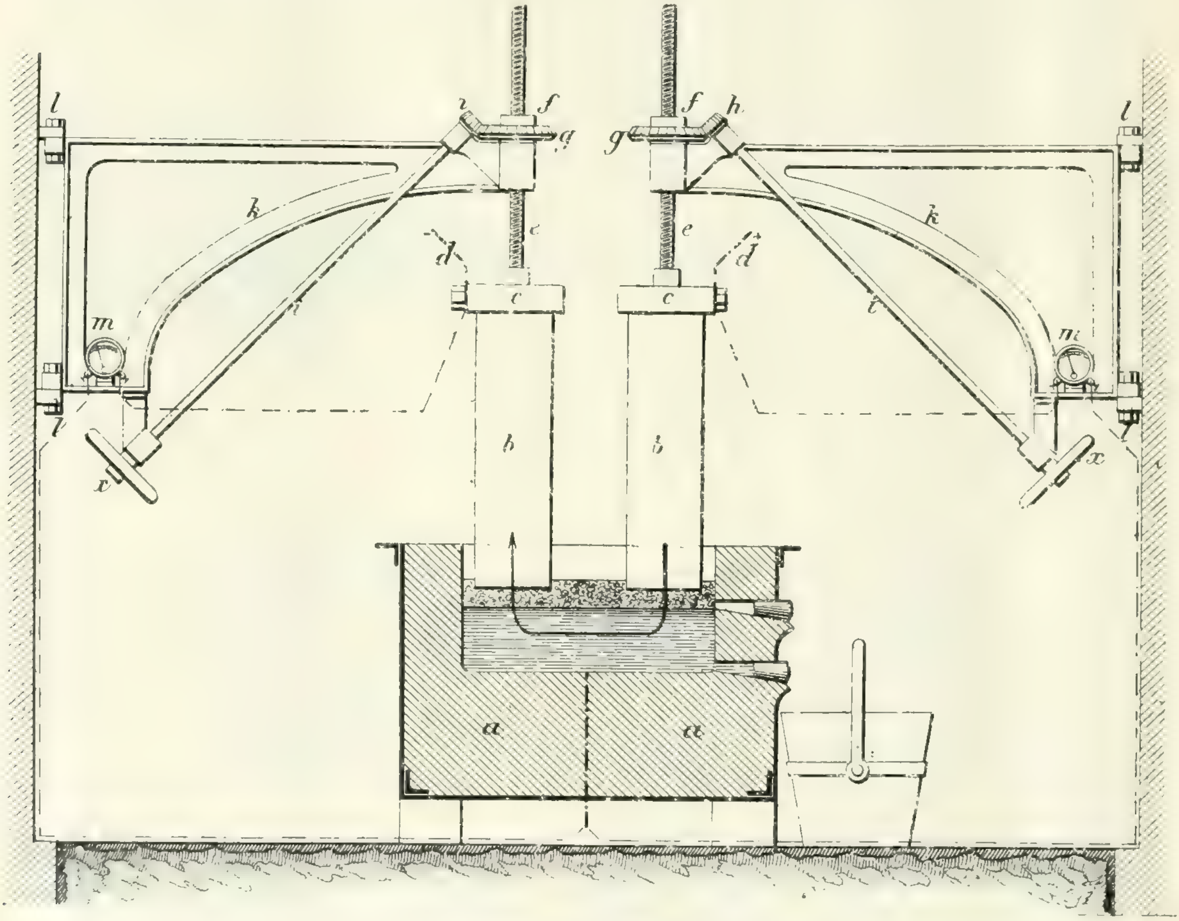


FIG. 1. FROGES-HEROULT ELECTRIC FURNACE.

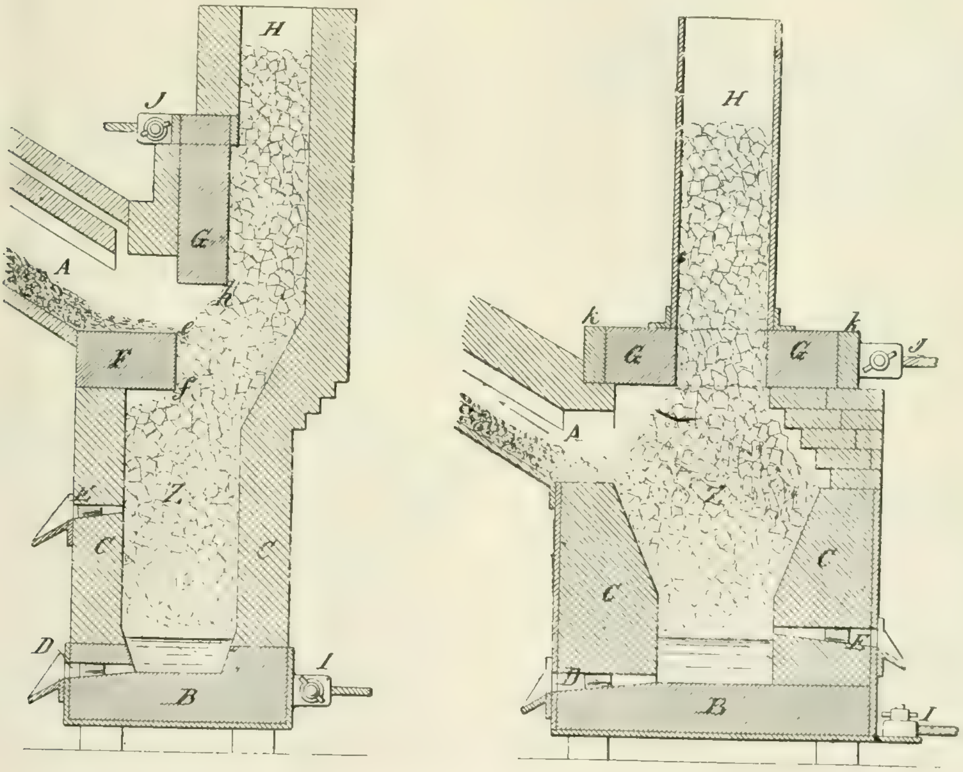
manufacture of ferro-chrome has been so successful that the use of the cupola for its production has been practically abandoned, and the price of material containing 60 per cent. of chromium has fallen from 1,800 francs per ton to 700–800 francs. Observations on the electrometallurgy of chromium naturally led M. Héroult to extend his work to the treatment of iron ores.

Héroult's researches on the electrometallurgy of iron comprise three well-marked stages. Between the first and second stages he made some very interesting experiments on the production of cast-iron. The first stage is marked by a patent taken out in March, 1900. The furnace is constructed in the same way as that used for the production of low-carbon ferro-chrome. It is sufficient to replace the chromite by an iron ore in order to obtain a cast-iron with little carbon. But this method could hardly be used for wrought-iron or steel. At first only pure materials could be treated, the elimination of impurities, like sulphur or phosphorus, not being then practicable. In fact, at the end of the operation there was present either much oxide which had to be recovered, or else metal too highly carburised.

PREPARATION OF CAST-IRON.

Here I will make a slight digression to speak of a series of experiments made by Héroult with the object of making cast-iron in the electric furnace, and to make the yield of his furnace sufficiently good to compete in certain cases with the blast furnace. The process is quite simple. The apparatus is charged in the usual way, putting at the bottom of the crucible a little of the metal, or the ore mixed with coal. But in this case much carbon monoxide is given off, which has no time to react, and the waste gases are much richer in carbon monoxide than those from the blast furnace. Héroult therefore endeavoured to recover the potential heat energy of this gas. This principle has been embodied by Héroult in an arrangement called an "economiser."

The ore, not mixed with the coal, reaches the crucible through a sloping or vertical flue, where it meets with the carbon monoxide passing away. At the commencement of this flue a blast of air is introduced to burn the carbon monoxide. The ore melts and falls into the electric crucible into which the coal is introduced directly through another opening. In figs. 2 and 3 the crucible, or final reaction chamber, is replaced by an

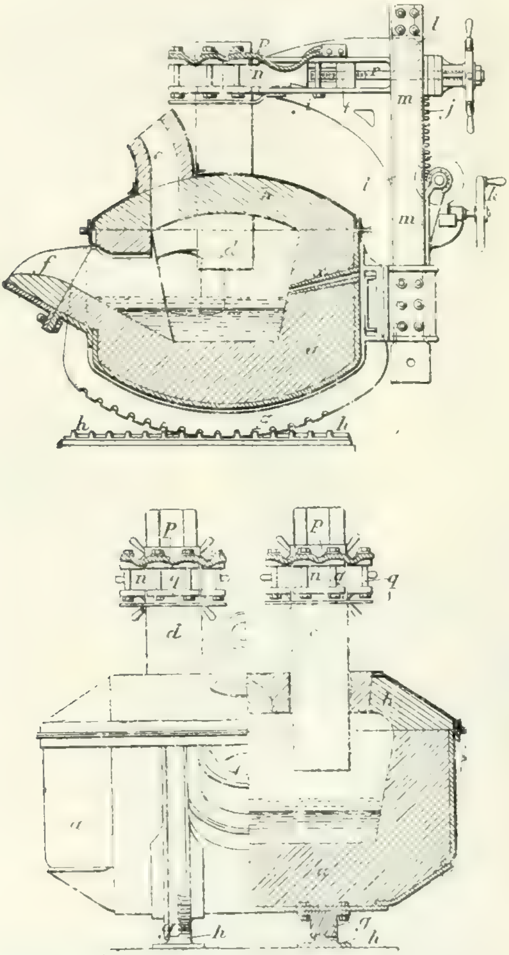


FIGS. 2 AND 3. SLIDING ELECTRODE FURNACE.

arrangement called by the author the sliding-electrode furnace. That is to say, it is the coal itself, which, in its downward progress inside the furnace, forms one of the electrodes, the base of the furnace and the melted metal forming the other.

In the second stage of the investigation the idea of reducing the oxide of iron and refining the metal in the same apparatus is abandoned, and by it the use of previously purified materials is obviated.

The furnace with two electrodes (see fig. 1) has two tap holes, one for metal, the other for slag, and is charged with solid or melted cast-metal from any source. When the metal is melted, the first slag is withdrawn and an oxidised slag is formed by the addition of minerals, the decarburisation of the ore is accomplished by the action of this slag on the fused metal. The oxidation being completed the slag is withdrawn and replaced by an artificial slag repeated as often as is necessary for complete purification.



FIGS. 4 AND 5. SHOWING ELECTRODES CARRIED IN SUPPORTS FASTENED TO FURNACE, AND MOVEABLE BY MEANS OF RACKWORK.

One of the advantages of the second modification of the Froges-Héroult process lies in the fact that a very high degree of freedom from sulphur and phosphorus can be obtained in the metal. The purification being accomplished, the required degree of carburisation is obtained by dipping an electrode or a block of carbon into the bath, this being followed by the addition of ferro-silicon, ferro-manganese, or aluminium.

A high degree of purification is obtained.

Analyses of a series of consecutive melts from average materials with commonly occurring impurities, show that with few exceptions the percentages of phosphorus and sulphur remain below 0·01 per cent.

Tests for tensile strength made on Froges electrical steels show satisfactory results.

MECHANICAL PROPERTIES OF ELECTRICALLY SMELTED STEEL

Resistance	Lengthening	Contraction	S per cent	P per cent	Mn per cent	C per cent	Si per cent
			Soft Steel				
53	26	0·48	0·009	0·024	0·32	0·295	0·05
43	30	0·55	0·006	0·012	0·32	0·14	0·14
49	28	0·49	0·006	0·015	0·28	0·25	0·22
42	31	0·55	0·007	0·016	0·297	0·136	0·07
36	31	0·746	0·016	0·006	0·076	0·089	0·003
38	33·5	0·726	0·018	0·010	0·105	0·107	0·04
39	30	0·706	0·005	0·007	[illegible]	0·044	0·073

The last sample but one had a Steinmetz coefficient, $\eta = 0·0011$ the last $\eta = 0·0012$.

Hard Steel.

Resistance	Lengthening	Contraction	S per cent	P per cent	Mn per cent	C per cent	Si per cent
68·5	18	0·40	0·015	0·007	0·125	0·70	0·035
82·9	11	0·23	0·011	0·005	0·19	1·38	0·09
73·3	15	0·29	0·007	0·009	0·187	1·49	0·148
86	13	0·29	0·006	0·009	0·08	0·88	0·148
76·2	18·5	0·23	0·017	0·006	0·16	1·30	0·129
69·5	17	0·36	0·003	0·004	0·11	1·19	0·065
49	30	0·55	0·010	0·011	0·51	0·70	0·06
48	28	0·59	0·009	0·026	0·38	0·207	0·06
57	28	0·50	0·021	0·010	0·48	0·285	0·465

From the 15th November, 1900, the metal, with the second variation of the process, was regularly produced in billets and ingots.

THE THIRD STAGE.

Before reaching the third stage of his researches, Héroult made important improvements in his process In the first place the furnace was made capable of oscillation, being moved by hydraulic or electric appliances. The electrodes were carried in supports fastened to the furnace itself by means of rack-work ; these could be moved automatically or by hand (figs. 4 and 5). An important advance in the oxidation and recarburisation of the metal was attained by the invention of "carburite." This is a mechanical carbide of iron, containing much carbon ; it is produced by agglomerating a mixture of iron filings and carbon. The product is dense enough to sink through the layer of slag and reach the metal below, in which it rapidly disintegrates owing to the high temperature of the air. In this way deoxidation and recarburisation can be attained without the use of any foreign material, such as silicon and manganese.

In the 400-h.p. oscillating furnace, a charge consists of 2,500 kilometres of scrap-iron. The melting takes five hours; tapping the first slag a quarter of an hour. The melted or solid artificial slag is then introduced, its melting and tapping takes half an hour. This operation is repeated with a second artificial slag. Each tapping of slag weighs 50–60 kilos. Then carburite is added to deoxidise and produce a steel with less than 0·6 per cent. of carbon. Below this percentage, the carbon content can be very accurately gauged in a trial piece. From the result of this test, the calculated amount of carburite is added. Finally suitable additions are made to reach the desired composition and the metal is tapped. The final addition of carburite and the other materials takes an hour.

Three cycles can be worked in the twenty-four hours as with the Martin furnace.

With the object of still further reducing the expenditure of electrical energy, the oxidation of the melted metal in the crucible is done away with. Starting with cast-iron a basic Bessemer or Martin oxidised metal is obtained. The oxidation is pushed further than is usual in order to completely eliminate the phosphorus. Thus while the ordinary Thomas metal contains 0·03 to 0·05 per cent. of phosphorus, the metal is over-blasted till less than 0·01 per cent. remains. According to the experiments of Héroult the amount of dissolved or combined oxygen in the over-blasted metal reaches 0·7 to 0·8 per cent. Such a metal would be useless in ordinary refining processes, in fact it would require the addition of large quantites of ferro-silicon or ferro-manganese. If, however, this melted metal is taken to the electric furnace, with all traces of phosphatic slag carefully removed, it can be completely deoxidised by means of carburite, and recarburised to the required point in about an hour. Suitable additions of ferro-silicon, manganese or aluminium are then made, and the metal tapped.

Practice has shown that the problem of the thorough deoxidation of steel has been completely solved by the electric furnace. By means of this improvement the output of a furnace becomes considerable, the operation should only take an hour, the energy consumed is greatly reduced, and labour is largely diminished. It thus becomes possible to manufacture second-rate and ordinary steels. Probably the net cost of the steel will always be slightly higher than that of Thomas or Martin, but this increase of cost in many cases is compensated by an improvement in the quality.

To conclude, the Froges-Héroult process is one which in the more or less near future must interest all branches of metallurgy.

Communicated to the Faraday Society.

THE S.S. "HARMONY."

The steel screw steamer *Harmony* has carried out her official trial trip in Hartlepool Bay. She has been built to the order of Messrs. J. and C. Harrison, Ltd., 66, Mark Lane, London, E.C., and is the third of three sister vessels built by Messrs. Furness, Withy and Co., Ltd., Hartlepool, for the same owners. The vessel is over 335 ft. in length, built on the deep frame principle with a measurement capacity of about 264,126 cubic feet. She is of the single-deck type, with poop bridge and forecastle and takes Lloyd's highest class. The hatches are of large size and are specially arranged for the stowage of bulky cargoes. Wood shifting boards are arranged throughout the holds, cellular double bottom is fitted all fore and aft for water ballast, the after peak being also available as a tank. The most modern appliances and auxiliaries are fitted, including patent steam steering gear at the after end of bridge in house, screw gear aft, winches of powerful design by Messrs. Furness, Withy and Co., Ltd., large multitubular donkey boiler, direct steam patent windlass and stockless anchors. The main engines, supplied and fitted by Messrs. Richardsons, Westgarth and Co., Ltd., Hartlepool, ran satisfactorily throughout the trial, a speed of 12 knots being maintained. The cylinders are 23 in., 40 in., 65 in., by 42 in. stroke with two single ended boilers 15 ft. 6 in. by 10 ft. 6 in. long-built to pass German Law requirements, and working at a pressure of 200 lb. per square inch. The owners were represented by Mr. F. A. Harrison, the builders by Messrs. Aspinall and Parker, and the engineers by Mr. Urquhart. The vessel proceeds to Buenos Aires.

The twin-screw steamer *Clacton*, a fast cargo vessel built to the order of the Great Eastern Railway, by Earle's Shipbuilding and Engineering Company, Ltd., Hull, on her official trial attained a speed of 14⅓ knots per hour, being one-third of a knot in excess of the contract requirements. The long distance trial of 120 miles, provided for by the contract, was completed at the Spurn Lightship. The whole of the long distance run gave 14·6 knots per hour.

OPENINGS FOR TRADE ABROAD.

Germany.

A despatch has been received at the Foreign Office from H.M. Ambassador at Berlin, reporting the exchange of ratifications of the two Treaties between Germany and Russia, which were signed on the 6th December last, concerning two frontier railway lines. These Treaties deal with the construction of a railway between the Warsaw-Kalisch line and the Prussian State Railway at Stalmierzyce, as also with the building of a line between the Herby-Czenstochowa railway and the Prussian State line at Herby. The result will be to facilitate not only local traffic but also internal communications. The length of the various lines to be constructed amount to about 497 miles.

Sweden.

According to the United States Consul at Gothenburg there is an opening for marine motors of the following types: Gasoline (benzine) motors for pleasure launches and boats; kerosene motors for fishing boats, barges, and small tugboats, and small, cheap motors which can be fitted into open rowboats. The Consul remarks that the persons in Gothenburg with means enough to buy first-class motor launches are comparatively few; still there are enough of them to warrant efforts on the part of manufacturers to get an extended market here. The motors should be reliable and in good working order when delivered, and not too expensive; and, he continues, if motors for 14 ft. to 16 ft. rowboats could be made very cheap, and still reliable, I think the demand would be considerable. There are a great many persons of limited means here who like to take a boat trip on the river, or out to the sea, in leisure hours, but even 50 dols. or 75 dols. would be considered by this class far too much for a small motor, when the boat itself could be bought for 13 dols. to 20 dols. The agent selling the motors should be thoroughly familiar with their mechanism—better still if he could have a small workshop where defects could be corrected.

Cape Colony.

The Town Council of Bedford have notified their intention of introducing a bill into Parliament to authorise the Council to acquire an improved water supply. For the purpose of carrying out the works contemplated under this bill it is proposed to raise a loan of £13,000.

The Municipality of Queenstown propose to supplement and increase the water supply of that district by constructing a reservoir and all necessary works connected. A sum of £90,000 will be required for the purpose.

During the ensuing session a bill will be introduced into the Cape Parliament to authorise the Town Council of Port Elizabeth to construct the necessary works for the supply of electrical energy for lighting and power purposes.

Portugal.

A royal commission has been appointed to formulate a scheme for the provision of lighthouses and buoys on the coast of the province of Mozambique.

Servia.

The Servian Government are about to undertake several important public works; these include the construction of light railways, the building of a quay and warehouses in Belgrade, and the improvement of the drainage and water supply of that city. Tenders were invited last year for the construction of railways 0·76 metre gauge; but very few tenders were received, and no adjudication took place. Tenders will be invited in the near future for the supply of rolling stock and metallic bridgework. If all the Government projects are carried out, 1,200 kilometres of railway will be constructed; all the materials will have to be imported.

Argentina.

The Minister of Public Works has been authorised to expend about £11,220 on the following items, to be used in adapting the military port at Buenos Aires to commercial purposes: four hydraulic cranes, one electric accumulator, four automatic weighing machines, thirteen mooring cables and eight anchors, together with the necessary accessories to these articles. All these goods are to be purchased in Europe through the Argentine Legation in London, where plans and specifications are to be forwarded.

ENGINEERING PHOTOGRAPHY.

MANY improvements have, according to the editor of the Process Year-Book,* been made of late in the methods of making prints from engineers' tracings. The cylindrical and semi-cylindrical printing apparatus was the first attempt to secure contact of the prints with the tracings. A sheet of plate-glass was bent to a half-circle and the tracing with the sensitive paper in contact with it laid over the surface, a canvas apron being drawn tight over the back. The glass, which was supported in a frame and swung on trunnions was brought to a vertical position, and an arc lamp suspended in the hollow of the half-circle. Further improvements led to the lamp being made to gradually descend by clockwork so as to evenly expose the whole of the print. It was also soon found that it was quite possible to expose two prints at once by making the apparatus cylindrical with two half-circles of glass joined together. Cylinders up to 9 ft. or 10 ft. in length have been built in this manner, and the apparatus has been brought to the greatest perfection. However, it seems likely now to give place to a still better principle. This consists of the adoption of the rotary principle, which has been applied with so much success to letterpress and lithographic printing, and latterly to bromide photo-printing.

At the Elswick works of Sir W. G. Armstrong, Whitworth and Co., Newcastle-on-Tyne, there is, probably, the largest photographic department in the kingdom in connection with an engineering firm, and an enormous number of prints of all kinds and sizes are turned out annually, not only by the cyano., ferro., and gallic and black line processes, but by silver printing, platino printing, bromide printing, etc., whilst photo-zincography in line and half-tone is being gradually developed. We quote the following additional details from the same source: The department owes its success to the organising ability and inventiveness of Mr. J. E. Goold, the chief photographer, but also not less to the liberality of the firm in permitting him to carry out the latest ideas. Mr. Goold has the distinction of having used the largest vacuum printing frame probably in the world, the pressure being applied by exhausting the air from under a rubber sheet which covered the back of the printing paper and tracing, thus utilising the pressure of the atmosphere. This frame, as I remember seeing it, was something like 10 ft. long by about 4 ft. wide. It was exposed by means of two powerful open type arc lamps.

This arrangement, as well as the cylinder printing apparatus, seems likely to be superseded by a novel apparatus which Mr. Goold has recently designed and had made in the Elswick works. It consists essentially of a cylinder formed of glass segments, which is slowly revolved in a horizontal direction, whilst a web of the sensitive paper is fed on to it, and at the same time the tracing to be printed is fed in in contact. Powerful arc lamps are directed on it, and the prints are fully exposed by the time the print has passed them. In this manner cyanotype prints 40 in. wide can be made at the rate of 200 ft. per hour, ferro-prussiate prints at 100 ft. per hour, ferro-gallic at 60 ft. per hour. It would be quite possible to feed in large celluloid film negatives, or even pieces of lace, with the advantage that the whole length of a lace curtain could be printed on to the paper. Thin zinc could also probably be printed in this way, so that the machine opens up great possibilities. It has been working successfully at Elswick for about seventeen months, and does nearly as much work as two of the vertical cylinders. One great feature of the new system is that prints of any length can be done, which is of great value for large continuous drawings.

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* Details of this interesting annual appeared in our last issue.

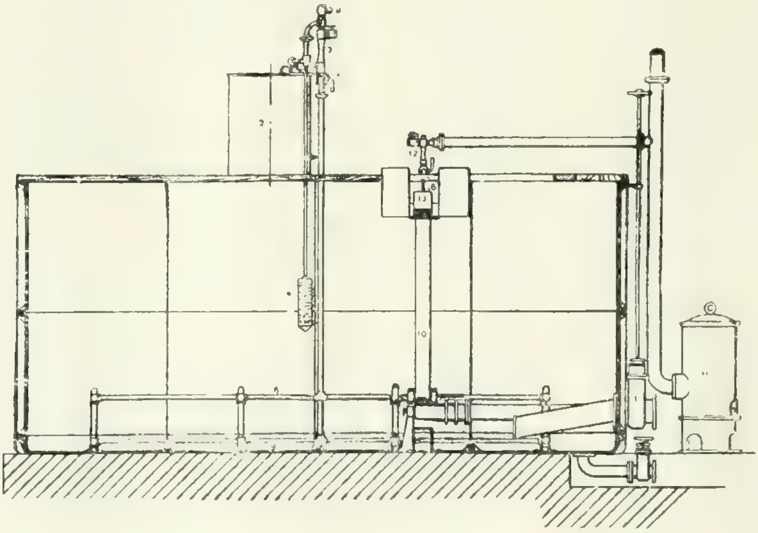
The Archbutt-Deeley Process of Softening and Purifying Water.

THE accompanying diagrams illustrate a plant on the above system suitable for the treatment of from 5,000 to 10,000 gallons per hour. It consists of a cast-iron tank, divided into equal parts by a transverse partition. The two tanks thus formed are fitted up exactly in the same way, the processes of filling, softening, and clarifying being carried on in one, whilst softened and clarified water is being drawn off from the other.

For 3,000 gallons per hour, and less, one softening tank is found to be sufficient if a storage tank is provided. For more than 10,000 gallons per hour, three or more tanks are desirable.

The hard water is admitted to either tank by means of the supply pipe (1) up to the level of a gauge mark on the side of the tank. While the tank is filling, quicklime and carbonate of soda are weighed out and boiled up with water in the small chemical tank (2) by means of live steam. Some waters require also the addition of a little aluminoferric. This is conveniently prepared in the form of a standard solution, of which a measured volume is added to each tank of water immediately after the chemicals have been run in.

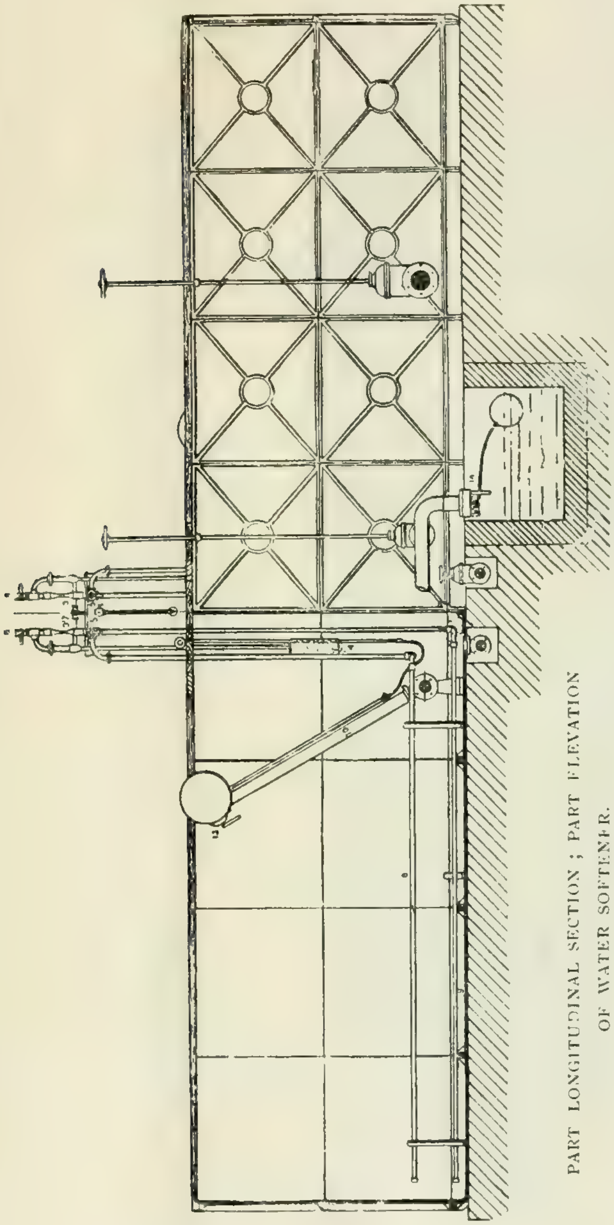
When the tank is full up to the mark, and the inlet valve has been closed, steam is admitted to the blower (3) causing a current of water to circulate up through the rose (4), the three-way tap (5), down the vertical pipe and back into the tank through the perforations in the upper row of horizontal pipes (6). The three-way tap (7) is then opened and the prepared chemical solution is slowly drawn into the circulating current, and thus diffused throughout the body of water in the tank. The air tap (8) is next opened to admit air through the pipe at the top of the blower, and the air is blown for a few minutes into the treating tank through the upper pipes (6); then by reversing the three-way tap (5) the air is forced through the perforations on the underside of the lower row of pipes (9). From these it rises in streams of bubbles, stirring up some of the precipitate or mud from previous operations which lies on the bottom of the tank.



CROSS SECTION OF PLANT.

1, Hard Water Supply; 2, Chemical Tank; 3, Blower for Air and Mixing Chemicals; 4, Perforated Rose; 5, Three-way Tap to Treating Tanks; 6, Upper Perforated Pipes; 7, Three-way Tap to Chemical Tank; 8, Air Tap on Blower; 9, Lower Perforated Pipes; 10, Floating Discharge Pipe; 11, Coke Stove; 12, Blower for Fuel Gas; 13, Discharge Mouth; 14, Ball Tap for Regulating Outlet; 15, Vent Pipe.

After the blower has been in operation for a few minutes (usually ten, but varying with different waters) the steam is turned off, and in about one hour very nearly all the precipitate settles to the bottom of the tank, while the water, even down to a depth of 6 ft. from the surface does not contain on an average more than about one grain per gallon of suspended matter.



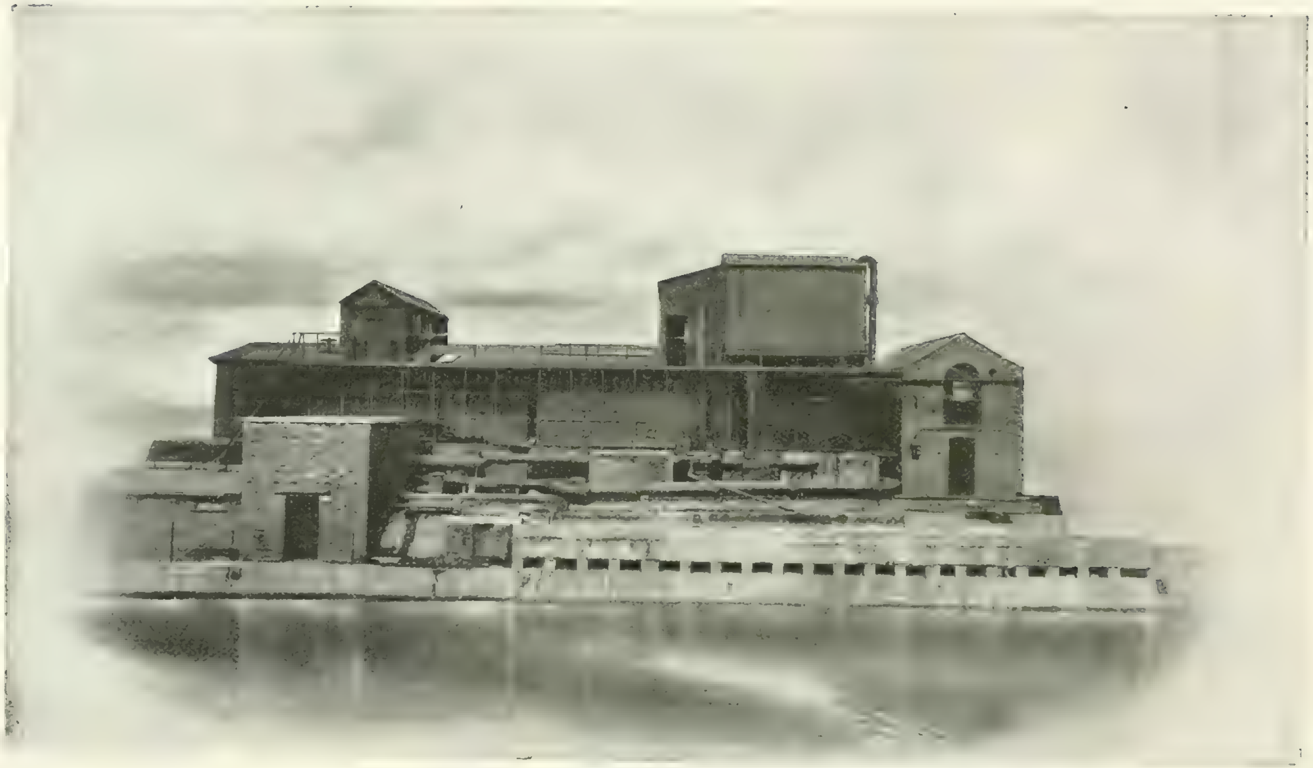
PART LONGITUDINAL SECTION ; PART ELEVATION OF WATER SOFTENER.

The operations of carbonating and drawing off are automatically and simultaneously effected by means of the hinged pipe (10) of rectangular section, the mouth of which is kept just below the surface of the water by means of floats. Fuel gas from the coke stove (11) is forced continuously, by means of the small steam blower (12), up the pipe, escaping by the discharge mouth (13), and being caught by the descending current of water (which in flowing down the pipe is repeatedly splashed upwards by baffles fixed at intervals along the bottom) is carried along with the water through the ball tap (14) fixed over the small supply tank, into which the softened and carbonated water falls, whilst the residual nitrogen, etc., of the fuel gas escapes into the air. If the small tank should fill up and cause the ball tap to close, the gas escapes through the vent pipe (15). A gauge mark on the side of the softening tank, about 2 ft. from the bottom, indicates the level below which the water is not drawn off. Shortly before the water reaches this level the further descent of the discharge pipe is stopped by a "rest" fixed on the bottom of the tank.

The quantity of carbonic acid required is only just enough to convert the slight excess of alkali used in softening into bicarbonate, and it is controlled by a very simple test. No injurious effects need be apprehended from the presence of sulphur in the coke, for, assuming the coke to contain 2 per cent, of sulphur, even if all this sulphur were to be oxidised to sulphuric acid, the quantity of sulphuric acid per gallon of water would amount to only 0·055 grain ; and as the softened water of three degrees hardness contains fully fifty times as much alkali as is required to neutralise this amount of acid, the sulphur in the coke cannot possibly do any harm whatever.

Experience proves that for boilers, carbonating is not always necessary ; and that where it is necessary occasional carbonating is often sufficient to prevent any trouble from deposit in feed pipes. The precipitate is prevented from unduly accumulating in the tank by its partial removal at regular intervals. This is effected in various ways to suit different circumstances. From the nature of the precipitate it is easily dealt with. In small plants, a discharge pipe is provided in one corner of the tank, and by lifting a plug daily a sufficient quantity of mud can be run off. In larger plants the mud is swept out, at longer intervals, through mud doors into a trough which conveys it on to waste ground; or it is raised out of the tank or trough by a steam lifter, and discharged into a cart lined with waste furnace ashes, through which the excess of water readily drains, leaving the nearly dry mud and ashes ready for tipping.

For the above details and illustrations we are indebted to the sole licensees, Messrs. Mather and Platt, Ltd., of Manchester and London.



WATER SOFTENING PLANT AT THE WILLESDEN WORKS OF THE METROPOLITAN ELECTRIC SUPPLY COMPANY, LTD.

A notable installation carried out by Messrs. Mather and Platt, Ltd on the Archbutt-Deeley system.

POWER STATION NOTES.

By E. K. S.

THERMAL LOSSES IN A BOILER.

We get so accustomed to considering the steam boiler as an excellent piece of apparatus not to be found fault with, that it is well perhaps to compare the theoretical figures with those actually obtained. A pound of good bituminous coal with the ordinary proportions of hydrocarbons and ash, when combined with its equivalent of oxygen will liberate 14,000 British thermal units; anthracite coal, being practically pure carbon gives a little more, namely, 14,700 British thermal units. Now the heat represented by a British thermal unit would, if expended in doing work, raise one pound weight, 778 ft. high. Therefore, the power in one pound of coal may be expressed as $\frac{14{,}000 \times 778}{33\,000} = 330$ h.p. As a matter of fact of the original 14,000 thermal units nearly 30 per cent. is lost when the coal is consumed under a boiler. One or two per cent. is accounted for by unconsumed coal in the ashes, 5 per cent. is lost in radiation from the boiler and pipes, and rather under 25 per cent. represents heat escaping up the chimney.

EVAPORATION POWER OF BOILERS.

Regarding the evaporation power of coal it happens that on account of the latent heat of steam, that is to say, the internal work done with the molecules of the steam when assuming the gaseous state, a pound of good bituminous cannot possibly evaporate more than 13 lb. of water if the water is at 62 deg. F., or 15 lb. if the water is at 212 deg. F. Now, in practice, the best boilers only evaporate a little over 10 lb. of water from and at 212 deg. F., and the usual figure is nearer 9 lb. Indeed, many boilers whose performances go unquestioned, would if tested, be found to come materially short of this. Yet buyers will accept boilers with a sort of blind faith and at the same time make no end of fuss about one or two per cent. in an engine or a dynamo, either of which has an efficiency immensely superior to that of the boiler.

AUTOMATIC COAL WEIGHING MACHINES.

An automatic weigher made by W. and T. Avery, has been supplied to several of the large electric power stations. For example, at Glasgow, 14 Richardson weighers are used in the chutes which supply coal to the mechanical stokers. Each machine weighs 2 cwts. of coal at a time, registering on a counter the exoct number of weighings made. In order to pass through such a machine the coal is of course broken up into pieces about one inch cube, but automatic machines can be made to weigh coal in pieces as large as six inches cube.

MECHANICAL STOKERS AND COAL CONVEYERS ON STEAMSHIPS

It has often occurred to the writer as somewhat strange that the boilers of liners, battleships, and large merchant vessels, are never fitted with mechanical stokers. Surely if mechanical stokers can be made to work so successfully for land boilers there is at least some chance of their succeeding on board ship. The new underfeed stokers appear to be a promising design for steamship conditions, because the coal lies fixedly in a V-shaped trough until it is consumed.

Trimming coal bunkers and bringing it forward to the boilers is another job for which coal conveyors or elevators might be used, and the screw type conveyor would probably be a useful form to adopt Much ingenuity has been expended in developing coal conveyors for central stations, gas works, and even for the coaling of ships at sea, so that it should not be a very difficult job for the experts of such a firm as the C. W. Hunt Company for example, to work out a suitable system of handling coal in the interior of steam ships. It would probably entail redesigning the coal bunker accommodation, but this is after all, merely a matter of re-arrangement of interior bulk-heads.

THE CUTTING ACTION OF HIGH VELOCITY STEAM.

The statement frequently made, that the blades of steam turbines do not show any signs of cutting, is a little difficult to understand by those who know how very much an ordinary stop valve, for example, may be worn by steam passing through it. It is the more inexplicable seeing that in a valve, it is the rush of steam between the valve and its seat just at the point of opening and closing which causes the cutting, or in other words it is the high velocity steam which does the work. As a matter of fact, it is very probable that there is cutting in a steam turbine, but inasmuch as it is spread over such a large surface the amount on each blade is almost immeasurable. The employment also, of superheated steam, no doubt tends to considerably reduce the cutting action.

SHIPBUILDING NOTES.

THE twin-screw steamer *Peshawur*, the latest addition to the extensive fleet of the Peninsular and Oriental Steam Navigation Company, was launched on the 8th inst., by Messrs. Barclay, Curle and Co., Ltd., Whiteinch. The new vessel, which is destined for their eastern and Australian service, is 496 ft. long by 57 ft. 3 in. in breadth by 35 ft. 9 in. in depth moulded. Her deadweight capacity is 10,500 tons, and she is specially designed for the requirements of the Australian trade.

The *Peshawur* is classed to the British Corporation highest standard, and carries a limited number of first-class passengers in commodious staterooms under the bridge. The officers' quarters are also under the bridge, and the crew are berthed in the poop and forecastle. The arrangements for working cargo, which includes ten large steam cranes, four winches, and five derricks (one for lifts up to 30 tons) are such as to ensure the rapid discharge of very large cargoes. Nos. 2 and 3 holds and lower 'tween decks are insulated for the carriage of frozen produce. The refrigerating machinery is placed in a large deckhouse on the upper deck in the forward well, and has been supplied by Messrs. Haslam on the cold air system to enable chambers being kept at a low uniform temperature.

The vessel is lighted throughout with electricity, and the 'tween decks are very efficiently lighted and ventilated in order to comply with the Admiralty requirements for carrying troops. The machinery consists of two sets of powerful triple expansion engines constructed by the builders, and are supplied with steam from two double-ended and two single-ended boilers, with a working pressure of 185 lb.

The vessel and machinery have been specially designed under the superintendence of Mr. Deane for the hull, and Mr. Leslie for machinery, and during the building has been supervised by Mr. H. J. Taylor, Greenock, assisted by Messrs. Lowe and Conner for the hull, and Messrs. Wilson and Smith for the machinery.

The *Peshawur's* keel was laid on 9th August, and the vessel is now launched in seven months from that date. It is expected that delivery will be completed and the vessel handed over in six weeks' time. The total time of construction will therefore be about eight and a half months, or two months earlier than the guaranteed date of delivery.

On Tuesday, the 7th inst., Messrs. Craig, Taylor and Co., launched from their Thornaby Shipbuilding Yard, Thornaby-on-Tees, the steel screw steamer *St. Patrick*, of the following dimensions, viz.: 316 ft. by 44 ft. by 22 ft. 6 in. moulded. She is built of steel to the highest class in Lloyd's, under special survey, and is of the single deck type, with poop, bridge, and topgallant forecastle; water ballast in double bottom fore and aft, and in peak. She is fitted with patent steam windlass, with quick warping ends, by Messrs. Emerson Walker and Thomson Bros., patent steam steering gear, nine large steam winches by Messrs. R. Roger and Co., Ltd., Riley's donkey boiler, Crawford's screw gear aft, and telescopic masts to Manchester Ship Canal requirements, and all the latest improvements. The propelling machinery has been constructed by Messrs. The North-Eastern Marine Engineering Company, Ltd., Sunderland. The ship and engines are being superintended by Mr. Fred Edwards, of London.

The s.s. *Talavera*, built by Messrs. Ropner and Son, of Stockton-on-Tees, for Messrs. Henry Scholefield and Son, of Newcastle-on-Tyne, has made a very satisfactory official trial trip in the Tees bay. Those on board included Mr. Dalgliesh, Captain Temple and Mr. Baxter, the owners' superintendents. Mr. J. R. Garthwaite was in attendance on behalf of the builders.

Messrs. Workman, Clark and Co., Ltd., of Belfast launched recently from their North Yard a handsomely modelled steel screw steamer, the *City of Karachi*, for the Ellerman "City" Line. The new steamer has a gross tonnage of over 5,000, and is intended for service between Glasgow, Liverpool, London and Calcutta. The *City of Karachi* has been built under the supervision of the British Corporation Registry, qualifying for their highest class, and she fulfils the requirements necessary for a Board of Trade passenger certificate. The five holds, into which the cargo space is divided by steel bulkheads, are capable of receiving locomotives, boilers and heavy machinery, all obstruction having been, as far as possible, avoided by the quarter girder principle of construction. Ample deck machinery has been arranged for rapid loading and discharging of a large and general cargo. Accommodation for a large number of passengers has been arranged. The machinery, which consists of a set of triple-expansion engines embodying the latest improvements, and supplied by steam for three steel multitubular boilers, fitted with forced draught on the Howden system, has been constructed at the builders' engine works.

RATING OF ELECTRICAL MACHINERY.

At the meeting of the Institution of Electrical Engineers last Thursday Mr. R. Goldschmidt read a paper on "Temperature Curves and the Rating of Electrical Machinery." The following is an abstract:

It is a well-known fact that the energy lost in electrical machines is converted into heat, which causes the temperature of certain parts to rise above that of the surrounding atmosphere, and results in a dissipation of heat by means of radiation or convection. If no dissipation took place at all, the temperature would simply continue to increase in proportion to the time until either the insulation was burnt or the metal was melted. Given the specific heat of the material the calculation of the temperature rise under any given conditions is a very simple matter, and in the case of the two materials, copper and iron, since their specific heat is nearly the same, we may assume an average value.

A CONVENIENT THERMAL UNIT.

As a thermal unit, the kilowatt-hour or watt-second is a more convenient one than the British thermal unit to adopt, and by this means a practical method of measuring the specific heat of copper and iron is arrived at.

In many cases in practice an instrument is used for a few minutes only, and not more than once or twice a day, as, for instance, in such apparatus as starting transformers, the choking coils of single-phase motors, the small motors used for starting synchronous motors, etc. In these cases it is useless to apply the well-known "watts per square inch" rule for calculating the temperature, and it is a mistaken idea in designing these machines, to take into consideration the providing of any cooling surfaces.

Machines which are to work only for a short time with interruptions sufficient to allow them to cool down to the temperature of the atmosphere must be so designed that the flux density and copper density do not exceed a certain amount independent of size and cooling surface.

It can further be stated that with short period apparatus, the flux density is practically only limited by the permeability of the iron, and not by heating, and in determining the section of the wire by the data available there is the certainty of an ample margin of safety, as the loss of heat by dispersion is not taken into account.

Dealing with the temperature curve the author points out that in order to determine the very important practical question, after what length of time a given machine will approach its final temperature within a few per cent., his method of arriving at the answer shows that the final temperature is attained within 5 per cent. at the end of three times the ideal heating time. For a commercial temperature test this time ought to be sufficient, as the temperature would be raised only 1½ deg. more after another hour, assuming the final temperature to be 50 deg. C.

CRANE RATING.

Dealing with crane rating the author points out that usually a crane motor has to stand a one hour's test on full load, independently of what it has to do in actual practice. It is naturally very much simpler to carry out a test of this kind than a test in which the motor has to be alternately switched on and off. It is even an easier test than a continuous rating test. This is the chief reason why the one hour's test is adhered to, and long experience in actual practice has proved that in nearly every case, a motor which stands this test with a moderate temperature rise, is large enough for crane work.

Investigation as to the meaning of the one hour's crane test shows, however, that its simplicity involves a very great inequality, these being a different value for every single machine. It would be desirable, therefore, to find a test, which would give accuracy as well as simplicity. A test with the exact conditions given, for instance, with a period of three minutes' running and seven minutes' stopping is, in practice, somewhat troublesome. Within rather wide limits, the temperature curve can be considered a straight line, and in consequence the temperature is only dependent on the load factor. Therefore, the three minutes' running and the seven minutes' stopping can be replaced by nine minutes' running and 21 minutes' stopping respectively, which would require less attention than the shorter period. The length of the period could be extended a little further still for large machines, and shortened a little for small machines. This "crane test with extended periods" certainly gives more exactness than the one hour's test, and enables the expression "crane rating" to be made more definite, and to allow for different load factors.

MINING NOTES.

WOLFRAM IN QUEENSLAND.

THE high prices and ready sale obtainable for Wolfram have induced hundreds of men to go prospecting for it from one end of Queensland to the other. The most activity prevails in the Walsh and Tinaroo mineral field. Wolfram is of a black or deep brownish-black colour, and has a lustre somewhat resembling black glass, but with a metallic or submetallic tinge. In breaking, it usually cleaves along flat, shining faces very much like antimony, and in this respect is very different from the conchoidal (or shell-like) fracture of broken glass. Where exposed on the surface this cleavage is not always present. The mineral has approximately the weight of metallic copper. On the Hodgkinson Goldfield wolfram and molybdenite frequently occur together in the same lode. The majority of the rich wolfram-producing claims at the Top Camp, Wolfram Camp, lie along a fairly continuous line of lode. The granite rock here, as shown by the exposures in the numerous shafts and open cuts is traversed by numerous contraction-cracks, lying roughly parallel to each other and to the surface of the ground. This occurrence gives the granite the appearance of being stratified, and has no doubt been caused by the shrinking of the granite as it cooled and solidified from a molten mass. In many of the claims the quartz of the lodes, on being followed down by vertical shafts for a few feet, has "cut out" on a floor of granite along which it spread in a horizontal direction. These horizontal veins, on being excavated by mining after the manner in which a horizontal coal-seam is mined, are seen to lie parallel to the contraction cracks of the granite, along one of which they have apparently been formed. These horizontal veins do not generally extend to any great distance laterally from the line of lode, being confined, as a rule, to within a short distance on either side of it. They vary greatly in thickness, and, as the granite is broken across by numerous vertically-disposed cross-joints they are very irregular in their course. The vertically-disposed cross-joints also frequently contain seams of quartz and mineral, as if they were formed previously to the disposition of the ore. The thickness of these seams of ore is never much more than 10 in. or 12 in. Some of the vertical standing main lodes, however, open out into large bodies 3 ft. and 4 ft. in thickness, but do not generally continue at that thickness for more than a few yards

ELECTRICITY IN MINES.

WITH reference to the list of new special rules issued by the Home Office regarding the installation and use of electricity in mines, the following letter has been addressed to each mine owner in the United Kingdom.—

Home Office,
Whitehall.

SIR, I am directed by the Secretary of State to transmit to you herewith a notice of proposal, under Section 54 of the Coal Mines Regulation Act, 1887, of new special rules regulating the installation and use of electricity in mines. The rules, which are based on the recommendations contained in the report of the Departmental Committee on the Use of Electricity in Mines, have been agreed upon in their present form between the Secretary of State and the Mining Association of Great Britain. It will be observed that a number of the detailed rules suggested by the Committee as to the construction, etc., of electrical apparatus have been omitted. It is proposed to embody these recommendations of the Committee in a Memorandum which will call attention generally to the points to be attended to in the erection of plant. This will be issued to colliery owners subsequently. The rules as to shot-firing recommended by the Committee have also been omitted (with the exception of two) as being out of place in the present code. The question of the adoption of the Committee's recommendations on this point will be considered separately. The Secretary of State is proposing these rules to all mines under the Coal Mines Act (with the exception of a few very small workings), whether using electricity at present or not, or whether using it for all the purposes dealt with in the rules or only for some of them. He considers it necessary to do this in order that the safety requirements laid down may come into force automatically, and without delay, immediately the use of electricity is introduced into a mine for all or any of the purposes dealt with. Where electricity is not at present used for any purpose other than shot-firing or is only used for minor purposes such as signalling, the rules will either not apply at all or only such as refer to that special purpose. If you do not object in writing to the rules within 20 days after the receipt of the rules by you, the rules will become established at your mine.—I am, etc.,

HENRY CUNYNGHAME.

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

Last Day.

Birmingham.—Supply and delivery of certain special tramway castings and works in manganese steel to British standard No. 4 section of rail, with all necessary fishplates, anchor pieces, and connecting rails of No. 4 and No. 4C sections, for the Public Works Committee. City Surveyor's Office ... ... March 20

Derby.—Supply and delivery of materials and construction of works in connection with the permanent way and electrical equipment of a portion of their authorised electric tramways, and the supply and delivery of cars. Plans, etc., for permanent-way construction from the borough surveyor and engineer (Mr. John Ward) and for the cars from the borough electrical engineer (Mr. T. P. Wilmshurst) ... March 21

Peterborough.—Supply and erection of the following plant, for the Corporation: (Section No. 1) Lancashire boilers, superheaters and economiser; (Section No. 2) triple expansion vertical engines, pumps, electric lighting set, travelling crane, workshop fittings, and tools; (Section No. 3) piping, injector, feed pump, tank, and feed-water softener. Mr. John C. Gill, Waterworks Engineer's Office, Peterborough ... ... March 23

Manchester. — Construction of a steel trough bridge, with concrete abutment, for the Manchester Ship Canal Company. Particulars from Mr. W. H. Hunter, chief engineer, 41, Spring Gardens, Manchester. March 23

Aston Manor.—Reconstruction of existing tramways in their district and the construction of other works in connection therewith, for the Corporation. Tramway contractors desiring to submit tenders for the works are requested to send applications to the consulting engineer, Mr. Robert Green, A.M.I.C.E., 37, Waterloo Street, Birmingham ... ... March 24

Grindleford and Rowsley.—Construction of the Grindleford to Rowsley section of the Derwent aqueduct, in the county of Derby, for the Derwent Valley Water Board. Mr. Edward Sandeman, Engineer, Bamford, Sheffield .. .. March 27

Hornsey. — Supply of cables, junction boxes, fuse boxes and meters. Mr. Norman Staniland, Electricity Works, Tottenham Lane, London, N. ... ... March 27

Marylebone.—Carrying out of certain installation work and alterations to existing consumers' installations in the Marylebone district for the Borough Council. Specification, etc., from the electricity offices, 11, Manchester Street, London, W. March 27

Last Day.

Keighley.—One Lancashire boiler, and one 300-k.w. direct-current steam dynamo, high-speed enclosed engine, for the Electricity Committee. Particulars from Mr. J. M. Smith, borough electricul engineer, Electricity Works, Keighley. Deposit, £1 1s. ... ... March 27

Great Yarmouth.—Supply and delivery of (Section 3) surface condenser, with steam-driven air and circulating pumps, for the Corporation. Messrs. Preece and Cardew, 8, Queen Anne's-gate, Westminster, S.W. March 29

Bolton.—Supply and erection of cooling tower and condensing apparatus in connection with power station, for the Electricity Committee. Mr. Arthur A. Day, borough electrical engineer, Spa Road, Bolton ... ... March 30

Manchester.—Supply and erection of a Livesey washer and a rotary washer scrubber, for the Gas Committee. Specification from Mr. C. Nickson, superintendent, Gas Department, Town Hall ... March 30

Shanghai.—The Shanghai Municipal Council invite tenders for the construction and operation of about 24 miles of electric tramways on the trolley system in the streets of the Settlement of Shanghai; alternative proposals are desired for the single-trolley and double-trolley lines. Council's agents, Messrs. John Pook and Co., 63, Leadenhall Street, London, E.C., and Messrs. Fearon Daniel and Co., 90, Wall Street, New York. ... ... March 31

Newport (Mon.).—Construction of main outfall and branch sewers for the Western Valleys Sewerage Board. Particulars at offices of Mr. Baldwin-Latham, Parliament Mansions, Victoria Street, S.W.; Mr. Geo. Chatterton, 6, The Sanctuary, Westminster, S.W.; or Mr. T. S. Edwards, Clerk to the Board, Newport (Mon.) .. April 1

Rishworth (Yorks.)—Construction of a concrete service tank (56,000 gallons), on Rishworth Moor, including wood and slate roof, for the Rishworth Urban District Council Waterworks. Messrs. Richard Horsfall and Son, surveyors and architects, 22a, Commercial Street, Halifax April 1

Birmingham.—Supply, delivery, and erection of 200 electric tramway cars for the Tramways Committee. Mr. Alfred Baker, general manager, 254A, Corporation Street, Birmingham ... ... April 4

Glasgow.—Electric power generating and lighting plant for Clydebank Dock, for the Trustees of the Clyde Navigation. Mr. T. R. Mackenzie, general manager and secretary, 16, Robertson Street, Glasgow, or from Mr. Geo. H. Baxter, mechanical engineer ... ... April 10

COMING CONTRACTS.

Darlington. Extensions of the electricity works, to cost from £2,000 to £3,000, are anticipated

Nottingham. The Corporation have approved the erection of a refuse destructor for Basford.

Burslem.—The Town Council have completed the purchase of land for the refuse destructor and electric lighting station at £4,340.

Faversham.—The Council are recommended to put down additional generating plant at an estimated cost of £4,800.

Finchley.—The Council are applying for sanction to a further loan of £23,500 for electricity extensions.

Gosport.—At the half-yearly meeting of the Gosport Waterworks Company it was mentioned, during the course of the meeting, that the new scheme for the supply of water was estimated to require a capital of £50,000.

Ayr.—At the last Council meeting a report from engineers on the proposed new reservoir for Kilbirnie and Glengarnock was approved, and it was resolved to ask for a loan for £21,500 to defray the cost of the works.

CONTRACTS CLOSED.

London.--The Brush Electrical Engineering Company, Ltd., have received orders for eight double-deck cars with radial trucks and Brush motor equipments, and overhead equipment for tramways for the Leamington and Warwick tramways, and eight 500 k.w. 3-phase transformers for the County of Durham Electrical Power Distribution Company.

London.—J. Williams and Sons, Cardiff, have secured an order for 1,500 tons of castings for one of the London tube railways.

London.—The City and South London Railway Company have let a contract to Walter Scott and Middleton for the construction of the extension of their line from the Angel, Islington, to Euston, about 1¼ miles.

Stockport.—R. W. Blackwell and Co. are supplying the overhead equipment for the electrification of the Hazel Grove route of the Stockport tramways.

Lochgelly.—The Wilson and Clyde Coal Company, Ltd., have placed an order with Andrew Barclay, Sons and Co., Ltd., for one of their Oddie-Barclay patent mine pumps, which is to raise 75 gals. per minute, 1,000 ft. head, at 160 revolutions per minute.

Middlesbrough.—The North Eastern Steel Company, Ltd., have placed an order with E. F. Jarvis for one of his Patent Open Type "British" Water-Cooling Towers, for cooling the Tuyere Water for their blast furnaces.

Chelsea. — The Chelsea Electricity Supply Company have accepted the tender of J. Greenwood, Ltd., for the erection of a new generating station at Manor Street, Chelsea, at £11,865.

King's Lynn.—The tender of the General Electric Company has been accepted by the King's Lynn Corporation for a steam dynamo (Belliss engine) with condenser and piping.

Brighton. — The Corporation last week accepted the tender of Siemens Brothers and Co. for the supply and laying of low-tension cables at £2,350.

Burslem.—The Corporation have accepted the tenders of Grant and Son for the erection of electricity works and refuse destructor buildings at £3,745 and destructor chimney at £850, and that of Crompton and Co. for switchboard at £508 and for arc lamps at £443.

APPOINTMENTS VACANT.

Last Day

Bermondsey.—Electrical engineer to the Council, at a salary of £425. The duties will include the management and running of the electricity and dust destructor works. Town Clerk, Town Hall, Bermondsey, S.E. March 22

Bristol.—Junior assistant for physics is required at Merchant Venturers' Technical College, Bristol. Salary £130 to £160. Particulars obtainable from Registrar March 23

London County Council.—Two divisional inspectors (at £600 per annum, rising by annual increments of £25 to £800), one possessing special qualifications in mathematics and science and the second in technology, including electrical and mechanical engineering; also an inspector in wood and metal work at £400, rising to £500... ... ... April 1

Middlesbrough.—The Education Committee require a teacher of engineering in the high school. Salary £200.... ...

APPOINTMENTS FILLED.

Transvaal.—Mr. L. S. Smart, the manager of the locomotive works at Brighton of the London, Brighton, and South Coast Railway Company, has been selected to fill the important position of chief locomotive superintendent of the Central South African Railways (Transvaal and Orange River Colonies).

Newcastle-on-Tyne.—Mr. Ernest Hatton, general manager of the Salford tramways, has been appointed tramway manager at Newcastle. The salary is £700 per annum.

Manchester.—The Town Council appointed Mr. Hancock, principal clerk in the traffic department, at £180 per annum, as parcels superintendent at a yearly salary of £250, and Mr. J. Eades, jun., car-works manager, at £250, as rolling stock superintendent at £350 a year.

Lisbon.—Mr. N. A. Bell, accountant in the tramways department of the Glasgow Corporation, has been appointed chief tramway accountant in Lisbon at a salary of £400 per annum.

Glasgow. — Mr. Lackie, chief assistant, has been appointed chief engineer of the electricity department in succession to Mr. Chamen. Mr. Lackie's salary is at present £500, and it was raised to £800, rising to £1,000. The Committee decided to ask the Council to sanction the appointment of Mr. Page, as chief assistant at a salary of £500.

Wigan.—Mr. Theodore Partington, engineer-in-chief of the Pemberton station, has resigned his position, and the Electric and Tramways Committee, has decided to put the Pemberton station under the sole control of Mr. Slevin, the borough electrical engineer.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies.

Stock Exchange Settling Days.—Settling days on the Stock Exchange are as follows:—
Consols: April 5th. General Settlements: March 30th, April 13th, 28th. Bank Rate, March 9th, 1905, 2½ per cent.

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares.	Last Dividend	Name.	Paid up.	Closing Prices.
11,370	5	5%	Alldays & Onions Pneumatic Engineering, Ltd.	3	2½— 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent. ..	5	4½— 5
3,210,000	1	2 6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3 5/16 - 3 7/16
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅜— 5⅝
1,500,000	100	4%	Do. 4% 1st Mort. Dbs. Rd.	100	104 —106
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg. Mt. Debs. Red.	100	96 — 99
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord. ..	1	4⅛— 4⅜
100,000	1	7½d.	Do. ,, 6% Cum. Pref.	1	1½— 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd., 6% Cum. Pref.	5	5 — 5½
250,000	1	6⅗d.	Baldwins, Ltd., 5½% Cum. Pref. ...	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 —103
150,000	4½	2/8⅖	Barrow Hæmatite Steel Co., Ld., O.	4½	1⅜ — 1⅝
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	4⅜— 4⅝
93,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4¾— 5¼
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50% pd	—	102 —104
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11¾ 12¼
£366,600	Stk	4%	Do 4% Deb. Stock, Red.	100	99 —101
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	⅝ — 11/16
300,000	1	6⅜d.	Do. 5½% Cum Pref.	1	21/32 — 23/32
£300,000	Stk	4¼%	Do. 4¼% Red. Deb. Stock	100	96 — 99
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O. Nos. 1-1,629,760	1	1 —1 1/16*
1,860,900	1	3⅜d.	Do. Nos. 1,639,101-3,500,000	12/-	17/32 — 19/32*
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1-1,160,000	15/-	1 3/16— 1 5/16
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1 15/32— 1 17/32
74,000	10	5/-	Do. 5% Cum. Pref.	10	11¼— 11¾
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord. ..	5	8¼ — 8¾
232,500	5	2/6	Do. 5% Cum. Pref. ..	5	5 5/16— 5 7/16
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	1 — 1 1/16
70,000	5	2/6	Do. 5% Cum. Pref	5	5⅜— 5⅝
£250,000	Stk	4%	Do 4% 1st Mort. Db. Stk. Red	100	100 —102
100,000	10	7/6	Consett Iron Co., Ltd., Ord	7½	32— 33
57 031	10	10/-	Crossley, Bros, Ld, Ord. 40340/97370	10	16½ 16¾
40,339	10	5%	Do 5% Cum Pref.	10	11⅞ 12⅛
75.000	1	2/6	Delta Metal, Ltd. Shares	1	2⅛— 2¼
1,259,594	1	3⅜d.	Dorman, Long & Co., Ltd.	1	⅝— 11/16
£400.000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk.	100	91 — 94
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating ..	5	3⅜ — 3⅝
250,000	1	9⅜d.	Dunlop (James) & Co., Ltd., Ord...	1	⅝— ¾
300,000	1	7⅕d	Do. 6% Cum. Pref. ..	1	[illegible] - [illegible]
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9 — 10
69,754	13	12/-	Do. do. do.	10	7⅜ - 7⅝
20,250	10	8/-	Elliott's Metal, Ltd.	8	4¾ - 5¼
5,000	10	5%	Do. Cum. Pref. 5%	10	8¾— 9¼
186,748	Stk	4%	Do. Deb. 4%	100	91½ - 96½
25,000	10	6/-	Fairfield Shipbuilding & Engng.Co., Ltd., 6% Cum. Pref. ..	10	10¾— 11¼
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	100 —103
9,000	10	10%	Fleming & Ferguson, Ltd. Ord Nos. 1/9000..	10	12½ 12¾
6,000	10	5%	Do. 5% Cum Pref. Nos. 9001/15000	10	9½ -10
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord. ..	3	4⅝— 4⅞
21,000	3	1 6	Do. 7½% Cum. Pref.	3	5¼ - 6¼
10,000	10	5%	Galloways, Ltd., 5% Cum. Pref. 18001/28000	10	6 — 7
£150 000	Stk	4%	Do 4% 1st Mort Deb Red..	100	90½—91½
16,800	10		Greenwood & Batley, Ltd., Ord. ..	10	4 — 4¼
9,600	10	7%	Do. 7% Cum. Pref .. .	10	10¼ 10¾
965,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2 5/16 2 7/16
344,000	5	2/6	Do. 5% Cum. Pref. ..	5	6 6¼
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk	100	107 109
13,000	5	2/6	Gwynnes, Ltd., 5% Cum Pref. ..	5	2 — 3
250,000	1	1/-	Hadfield's Steel F'dry Co., Ld., Ord.	1	3 1/16 3 3/16
20,000	10	4/6	Do. 4½% Cum. Pref. .. .	10	10¾ — 11¼
30,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref...	5	5 5½
408,505	1	1/6	Harvey United Steel Co., Ltd. ..	1	1 5/16— 1 7/16
47,500	10	7½%	Hawthorn, Leslie & Co., Ltd. Ord.	10	10½ 11
28,001	5	7/-	Head, Wrightson & Co., Ltd. .	5	4¾— 5¼
85,000	1	7½d.	Hill (Richard) & Co. (1899) Ld., Ord.	1	⅝— [illegible]
18,000	5	3/-	Do. 6% Cum. Pref.	5	4⅜ 4⅝
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5½ - 6

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend.	Name	Paid up.	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord. ..	1	1⅝ - 1¾
25,000	10	6/-	Do. 6% Pref. (Non-Cum.) ..	10	13 - 13½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red after 1905	100	98 101
37,500	10	20	Kynoch, Ltd.	10	18¾ 19¼
49,537	10	5%	Do. Cum. Pref. 5%	10	10¾ - 11¼
300,000	1	4⅘d	Lambert Bros., Ltd., Ord.	1	⅝— ⅞
50,000	5	2/9	Do. 5½% Cum. Pref. .. .	5	4 — 4½
40,000	3	2/1½	Leeds Forge Co, 7% Cum. Pref. ..	3	3¾ - 4¼
200,000	1	7⅕d	Lysaght (John), Ltd., 6% Cum. Pf.	1	1 5/16 - 1 7/16
£300,000	Stk	4½%	Do 4½% 1st Mt Deb. Stk., Red.	100	108 —110
40,000	10	5/-	Mather & Platt, Ld., 5% Cum. Pref	10	11 —11½*
210,000	1	8⅖d.	Measures Bros., Ltd, Ord.	1	⅝ ¾*
75,000	1	6⅗d.	Do. 5½% Cum. Pref.	1	⅞ - 1
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	94 — 97
21,943	5	2/6	Muntz Metal, Ltd.	5	5½— 5¾
14,248	5	5%	Do. Pref. 5%	5	5⅛— 5⅜
5,000	62½	47/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref.	62½	76 — 80
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	12⅛ — 12⅜
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	—
£250,000	Stk	4½%	Do. 4½% 1st Mt. Db. Stk., Red.	100	90 — 93
122,000	5	2/-	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	4 — 4¼
50,000	5	3/-	Do. 6% Cum. Pref. "A" ..	5	5¾— 6¼
70,000	10	6/-	Pease & Partners, Ltd., Ord. ..	10	10½— 11
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97 —100
20,000	5	3/-	Peebles(Bruce) & Co.,Ld., 6% Cm.P.	5	4¾— 5
65,000	1		Pooley (Henry) & Son., Ltd., Ord ..	1	6/6— 7/-
13,000	5	–	Do. 5½% Cum. Pref. .. .	5	4 — 4¼
230,000	1	—	Projectile Co. (1902), Ltd., Ord. ..	1	½— ⅝
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅘— 2
73,062	5	2/-	Do. New	5	1½ 1¾
£330,000	—	5%	Do. 5% Mort. Deb., Red. ..	100	100 —102
350,000	1	7⅕d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf. ..	1	⅞ - 15/16
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock ..	100	94 — 96
35,000	10	12/-	Ruston, Proctor & Co., Ltd... ..	10	9½— 10
275 000	1	6d.	Scott (Walter), Ltd., Ord.	1	13/16— 15/16
300,000	1	7⅕d.	Do. 6% Cum. Pref. ..	1	1— 1⅛
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk	100	94 — 96
£115,300	100	5%	Shelton Iron, Steel and Coal Co., Ld. 1st Charge 5% Debs.. Red ..	100	92 — 95
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 - 95
250 000	1	1/-	South Durham Steel & Iron, Ltd.Or.	1	⅝— 11/16
300,000	1	7⅕d.	Do. 6%Cum. Pref...	1	15/16 — 1
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	90 93
49,560	10	2½%	Steel Co. of Scotland Ord. 1/49560..	9	5 5¼
£125,240	Stk	5%	Do. 5% Trust Mort. Deb. ..	100	106½ 107½
25,000	10	-	Stephenson (Robert) & Co., Ltd., Or.	10	2¼ 2¾
25.000	10	5/6	Do. 5½% Cum. Pref. ..	10	4¼— 4¾
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	79— 82
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord. ..	10	17¼— 17¾
55,000	10	6/-	Do. 6% Cum. Pref .. .	10	14¼ 14¾
634,732	1	4.69d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	[illegible]
538,845	1	6d.	Do. 5% Cum. Pref .. .	1	15/16 1 1/16
£240,000	Stk	4¼%	Do. 4¼% 1st Mort. Deb Stk. Rec	100	98 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ 9/16
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	67 — 71
£160,000	1	7⅕d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref	1	13/16 - 1 1/16
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum.Pf.	10	9½ 10
$508495200	$100	$½	United States Steel Corp. Com.Stk	$100	37¼ 38
$360314100	$100	$1¾	Do. 7% Cum. Pref. Stock	$100	99⅜ 99⅝
$162268600	$1000	5%	Do. 10-60yr. 5% Skg.Fd.G.Bds.	$1000	98 100
3,350,000	1	1/-	Vickers, Sons & Maxim Ltd. Ord..	1	2 9/16 2 11/16
750,000	1	6d.	Do. 5% Non-Cum. Pref. .	1	1 1/16 1 3/16
£750,000	Stk	5%	Do. 5% Non Cum. Pref. Stock.	100	116 119
£1,250,000	Stk	4%	Do. 4% 1st. Mort. Deb. Stk. Red.	100	106 108
£1,000,000	100	4½%	Do. 4½ 2nd Mort. Debs., Red.	100	106 108
225,000	1	1/2⅖	Weardale Steel, Coal & Coke, Ltd., Def. Ord.	1	[illegible]
500,000	1	7⅕d.	Do. 6% Cum. Pref. Ord. ..	1	[illegible] 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	85 89
7,637	5	2 9	Weldless Steel Tube, Ltd., Cum. Pref. 5½	5	4¼ 4¾
300	Stk	4½%	Do. Mort. Deb. 4½%	100	91 97
66,666	5	3/-	Willans & Robinson, Ord.	5	1½ 2½
66,666	5	3/-	Do. 6% Cum. Pref.	5	3 4
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	78 83
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	81 85

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5%, Cum. Pf.	1	⅝ — ⅞
125,000	1	7½d.	Aron Elec. Meter Ltd., 6%, Cum Pf.	1	7/16 — 9/16
120,000	1	9½d.	Bell's Asbestos Co., Ltd.	1	1⅛—1⅜
100,000	5	4/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5¼— 6¼
100,000	5	3/-	Do. 6%, Cum. Pref.	5	5½—5¾
£500,000	Stk	4½%	Do. 4½%, 1st Mort. Deb. Stk. Rd.	100	101 —104
£200,000	Stk	4½%	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	99 101*
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 6% Pref. ..	5	3⅛— 3⅜
£616,358	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	91 - 93
105,731	2	2/-	Brush Elec. Enging. Co., Ltd., Ord. .	2	½— ¾
150,000	2	2/4⅘	Do. 6% Pref.	2	1½— 1¾
£125,000	Stk	4½%	Do. 4½% Perp. 1st Deb. Stk...	100	92 — 95*
£125,000	Stk	4½%	Do. 4½%, Perp. 2nd Deb. Stk.	100	79 — 82
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	11 11½
40,000	5	2/6	Do. 5%, Cum. Pref. . ..	5	5½ 5¾
£200,000	Stk	4½%	Do. 4½%, 1st Mort. Deb Stk. Red.	100	105 107
85,000	3	1/6	Crompton & Co., Ltd...	3	2⅛ — 2⅜
£100,000	—	5%	Do. 5%, 1st Mort. Reg. Debs.	100	93 — 98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	8 - 8½
61,000	5	3/-	Do. 6%, Cum. Pref.	5	5⅞ - 6⅛
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	106 —108
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1¼ - 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	106 109
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	⅞ 1⅛
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1½ 2
£344,023	Stk	4%	Do. 4%, Deb. Stock Red. .	100	80 -- 85
£100,000	Stk	5%	Do. 5%, Second Deb. Stk. Red.	100	86 — 91
112,100	2	1/7½	Electric Construction Co., Ltd. ..	2	1⅛— 1¼
31,390	2	2/9⅗	Do. 7%, Cumulative Pref. ..	2	2¼ - 2½
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 — 99
10,248	10	7/6	Evered and Co., Ltd... ..	10	12 14
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red...	100	90 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9½ - 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	13 —13½
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅜— 5⅝*
£50,000	Stk	4½%	Do. 4½%, Mt. Deb. Stk. Red.	100	109—111*
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	16 — 17
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	100 —103
7,500	10	--	Parker, Thos. Ltd.	10	6½ -- 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/-—17/-
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	36 - 38
£150,000	100	4%	Do. 4% Deb. Bonds	100	103 105

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8¼ — 8¾
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅜ - 5⅝
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	12 — 12½
10,000	10	5/-	Do. 5%, Cum Pf. Shares	10	9 -- 10
£16,300	100	5%	Do. 5% Debs., Red. ..	100	99 --102
£191,326	Stk	4½%	Do. 4½%, Red. Deb. Stk.	100	96 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	¾ ⅞
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	15/16 1 1/16
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1¼— 1¾
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3¾ 4¼
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 — 98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	103 - 106
		%	Pref. Ord. Stock	100	100 103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¼ - 9¾
156,477	10	6/-	Do. 6%, Cum. Pref.	10	10⅞—11⅛
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	121 --123
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red. .	100	97 — 99
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	3¼ 4
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5⅝ 5⅞
27,000	5	3/-	Do. "B" do.	5	5⅜— 5⅝

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend	Name	Paid up.	Closing Prices.
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Db. Stk., Red.	100	95 — 98
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	103 —106
102,268	5	3/-	Calcutta Tramways Co., Ltd. ..	5	8¾ 9
£350,000	Stk	4½%	Do. 4½%, 1st Deb. Stk., Red.	100	106 —108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1¼— 1½
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5%, Cum. Pref.	5	4⅞— 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 - 104
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13 — 14
59,987	10	6/-	Do. 6% Pref...	10	15½— 16½
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3 — 3½
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	89 92
125,000	10	5/-	London United Trams. (1901), Ltd., 5%, Cum. Pref.	10	10 —10½
£1,031,000	Stk	4%	Do. 4%, 1st Mort. Deb. Stk. Red.	100	99 —102
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5%, Deb Stock, Red.	100	101 —103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	¼ [illegible]
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	15/16 1
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	105 —107
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ - 1½
110,923	8	3/2½	North Metropolitan Tramways Co..	8	4 4½
£150,000	100	3½%	Do. 3½%, Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	104 —107
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	9¼— 9¾
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	9 — 9½
£220,000	Stk	4½%	Do. 4½%, Deb. Stk., Red.	100	102 -105

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares.	Last Dividend	Name	Paid up.	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12¼— 12¾
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9¾— 10¼
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	105 —107
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5¼ - 5¾
£50,000	Stk	4½%	Do. do. 4½%, 1st Deb. Stk. Red.	100	101 —104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10¼ — 10¾
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	10¼ — 10¾
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	9 — 9¼
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	8 — 8½*
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5½— 5¾
£350,000	Stk	4%	Do. do. 4%, Deb. Stk. Red.	100	103 —105
44,436	5	3/9	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6¾— 7¼*
£150,000	Stk	4½%	Do. do. 4½%, Deb Stk., Red	100	109 —111
70,595	10	5/-	City of London El. Lghtg. Co., Ld., O.	10	12½ 13
40,000	10	6/-	Do. 6% Cum. Pref.	10	13¾— 14¼
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	123 —127
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	103 —105
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9½— 10
30,000	10	6/-	Do. 6% Cum. Pref.	10	12¼ - 12¾
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	110 —113
70,000	5	2/6	Edmundson's Elec. Cor. Ltd., Ord.	5	6¼ — 6½
70,000	5	3/-	Do. 6%, Cum. Pref. . ..	5	6⅜— 6⅝
£300,000	Stk	4½%	Do. 4½%, 1st Mort. Db. Stk. Reg	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O	5	5½— 6
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9½—10½
13,000	5	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7½— 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	101—103
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	⅝— ¾
21,000	5	7/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12¾—13¼*

Stocks and Shares marked * are quoted ex-dividend.

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares.	Last Divi-dend.	Name.	Paid up.	Closing Prices.
£135,000	Stk	4%	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4% Deb. Stock, Red.	100	102 —104
111,000	3	1/9¾	London Elec. Supply Corp., Ld., Ord.	3	2 9/16—2 11/16*
60,000	5	3/-	Do. 6% Pref.	5	5¾ — 6*
£371,895	Stk	4%	Do. 4% 1st Mort. Db. Stk., Red	100	99 —101
100,000	10	9/-	Metropolitan Elec. Sup. Co., Ld., Or.	10	19½— 19¾
76,121	5	2/3	Do. 4½% Cum. Pref.	5	5⅝ — 5¾
220,000	Stk	4½%	Do. 4½% 1st Mort. Db. Sk., Red.	100	110 —115
250,000	Stk	3½%	Do. 3½% Mort. Deb. Stk., Red.	100	97 — 99
£250 000	—	4½%	Midland Elec. Corp. for Power Distribution, Ld., 4½% 1st Mort. Deb.	100	97 —100
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½ - 15
£59,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	102 —104
16,500	5	2/6	Oxford Electric Co. Ltd., Ord. ..	5	6¼— 6½
£50,000	Stk	4%	Do. 4% Debenture Stk. Red.	100	98 —100
£84,700	100	4½%	Royal Elec. Co. (of Montreal) 4½% 20-yr. 1st Mort. Deb	100	100 —102
40,000	5	9/6	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¾ —14¼*
20,000	5	3/6	Do. 7% Pref.	5	8¼— 8¾*
£150,000	Stk	3½%	Do. 3½% Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2⅝— 3⅛*
£50,000	Stk	4%	Do. 4% Debenture Stk Red.	100	79 — 83
65,000	5	3/-	South London Elec. Sup. Co., Ltd. O.	5	4¼— 4½
100,000	1	—	South Metropolitan Elec Light & Power Co., Ltd. Ord.	1	⅞ — 1
50,000	1	8⅖d.	Do. 7% Cum. Pref.	1	1 13/16—1 15/16
£100,000	Stk	4½%	Do. 4½% 1st Deb. Stock Red.	100	107 —110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	5 1/16—5 3/16
30,000	5	2/6	Do. 5% Cum Pref.	5	5⅛— 5¼
£200,000	Stk	—	Do. 4½% 1st Mort. Deb. Stk. Red	100	106 —108
110,000	5	7/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	12¾ —13¼*
28,151	5	2/6	Do. 5% Cum. Pref.	5	6¼— 6¾

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares.	Last Divi-dend	Name.	Paid up.	Closing Prices.
£31,800	100	4%	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 —102
25,000	10	—	Amazon Telegraph Co., Ld... ..	10	2¼ — 2¾
£763,580	Stk	17/6	Anglo-American Tel. Co., Ltd., Ord.	100	61 — 63
£3,118,210	Stk	35/-	Do. 6% Preferred Ordinary	100	108½ 109½
£3,118,210	Stk	2/-	Do. Deferred Ordinary .	100	16½— 16¾
44,000	5	3/-	Chili Telephone Co., Ltd.	5	6⅜— 6⅝
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	230 —240
£1,903,856	Stk	4%	Do. Sterl. 500-yr 4% Deb. Stk., Red.	100	97 — 99
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾— 9¼
6,000	10	10/-	Do. 10% Preference	10	17 — 18
6,000	5	2/-	Direct Spanish Telegraph Co., Ord.	5	3⅜ - 3⅝
		5/-	10% Cum. Preference	5	8¼ - 8¾
£30,000	50	4½%	Do. 4½% Debs...	50	101 103%
60,710	20	3/-	Direct U.S. Cable Co., Ltd... ..	20	11⅜—11⅝
£85,800	100	4½%	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	100—102
£300,000	100	4%	East. & S. African, Ld., 4% Mt. Dbs.	100	100 –102
£200,000	25	4%	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy) ..	25	101-103%
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	14½ - 15
£602,400	Stk	4%	Do. 4% Mort. Deb. Stk., Perp.	100	105 —107
£4,000,000	Stk	25/-	Eastern Tele. Co., Ltd., Ord. ..	100	145 —148
£2,000,000	Stk	17/6	Do. 3 % Pref.	100	92 — 94
£1,836,814	Stk	4%	Do. 4% Mort. Deb.	100	106 —108
150,000	10	5/-	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	32½— 33½
£58 700	100	4½%	Halifax and Bermudas Cable Co., Ltd., 4½% 1st. Mort. Debs. Red.	100	100 -102
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	46½ - 48½
72,680	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	13/16 - 15/16
£1,983,333	Stk	6%	National Telephone Co., Ltd., Pref.	100	112½—113½
£1,966 667	Stk	5%	Do. Deferred	100	106 -108
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5½ - 5¾
£2,000,000	Stk	3½%	Do. 3½% Deb. Stk., Red. ..	100	100 -102
£689,593	Stk	4%	Do. 4% do. do. ..	100	104 —106
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1¼ — 1⅜
50,000	1	7½d.	Do. 6% Cum. Pref.	1	1 3/16 — 1 5/16
£100,000	100	4%	Pacific & European Tel. 4% Guar. Debs. Red...	100	98 —101
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7¼— 7¾
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	7¼— 7¾
40,000	5	2/6	Do. 5% Cum. Pref.	5	5 — 5¼
£179,947	Stk	5%	Do. 5% Deb. Stock, Red. ..	100	106 – 108
15,609	10	4/-	W. African Telegraph Co., Ltd. ..	10	8 — 8½
£30,008	2½	—	West Coast of America, Ltd. ..	2½	1/16 — 7/16
150,000	100	4%	Do. 4% Deb. Guar. by West. Tel.	100	100 — 102

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed.	Shares	Last Divi-dend.	Name	Paid up.	Closing Prices
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	⅞ — 1
34,563	10	6/-	Do. 6% Cum. 1st. Pref. ..	10	8½ - 9
4,669	10	6/-	Do. 6% Cum. 2nd Pref. ..	10	8¼ 8¾
£80,000	100	5%	Do. 5% Deb.	100	103 —105
207,930	10	3/-	Western Telegraph Co., Ltd. ..	10	13¾— 14¼
£75,000	100	5%	Do. 5% Debs., 2nd Series, 1906	100	101 —103
518,945	Stk	4%	Do. 4% Deb. Stock, Red. ..	100	103 —105

VI.—SHIPPING COMPANIES.

Present Amount Subscribed.	Shares	Last Divi-dend.	Name.	Paid up	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½% Cum. Pref.	10	8½— 9
£325,000	Stk	4½%	Do. 4½% Red. 1st Mort. Deb. Stk.	100	99 —101
£672,900	Stk	4½%	British & African Stm. Nav. (1900 Ltd., 4½% 1st Mort. Deb. Stk. Red.	100	93 — 95
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½% Cum. Pref.	10	6 — 6½
£600,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk.	100	75 — 78
£750,000	Stk	4½%	Clan Line Steamers, Ltd., 4½% Deb. Stk. Red. ..	100	98 —100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000..	20	13¾ - 14¼
40,000	20	8/-	Do. Nos. 60 001-100,000	10	5½— 6
£464,430	Stk	4½%	Elder Dempster Shipping, Ltd., 4½% 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1 1/16 -1 5/16
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4¼— 4¾
36,758	8	4/9⅗	Do. Non-Cum. 6% Pref.	8	7½— 8
£150,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red..	100	99 —101
55,000	5	1/3	Houlder Line, Ltd., Ord.	5	2½ – 3
40,000	5	2/9	Do. 5½% Cum. Pref.	5	3¼ – 3¾
£200,000	Stk	4½%	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 — 86
141,500	10	5/-	Leyland (Fredk.), & Co. (1900), Ltd., 5% Cum Pref. ..	10	5¼ 5¾
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5% Cum. Pref. ..	100	131 134
£1,160,000	Stk	19%	Do. do Deferred ..	100	225 -228
15,000	100	30/-	Royal Mail Steam Packet Co. Ord ..	60	25½ — 26½
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5% Cum. "A" Pref..	5	4¾ - 5¼
39,075	5	2/6	Do. "B" Ord... . ..	5	4 - 4½
141,841	10	4/-	Union Castle Mail Steamship Co., Ltd., Ord..	10	8¼ - 8¾
21,000	10	4/6	Do. 4½% Cum. Pref...	10	10 — 10½
£1,008,894	Stk	4%	Do. 4% Debenture Stk., Red.	100	99 —101

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed.	Shares.	Last Divi dend	Name.	Paid up.	Closing Prices.
60 000	1	9⅗d.	Chadburn's (Ship Tele. Ltd., Ord...	1	⅞ - 1⅛
£750,000	Stk	5%	General Hydraulic Power Co., Ltd.	100	133 —138
12,500	10	10/-	Oakey (John) and Sons, Ltd., Ord..	10	24 — 26
10,000	10	6/-	Do. do. 6% Cum. Pf.	10	14 — 15
183,538	1	6·3d.	Power Gas Corp., Ltd., Ord., Nos. 66,463-250	15/-	5/16 7/16
66,462	1	8·4d.	Do. do. Nos. 1 66,462	1	9/16 - 11/16
135,000	1	6d	Waygood (R.) & Co., Ltd., Ord. ..	1	1 1/16 1 3/16
135,000	1	7½d.	Do. 6% Cum. Pref. ..	1	1⅛— 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

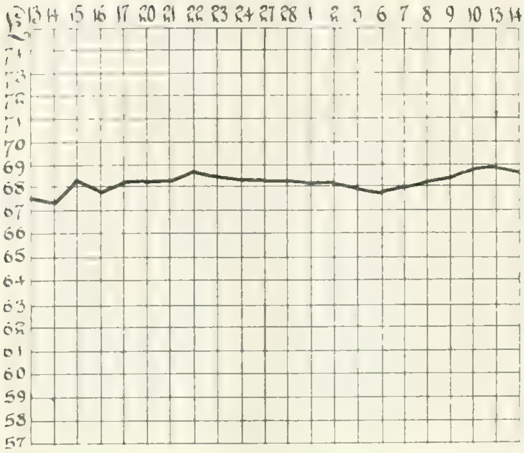
Present Amount Subscribed.	Shares.	Last Divi-dend	Name.	Paid up.	Closing Prices.
10,000	10	7/6	Birm. Railway-Car. & Wagon, L., 1-10,000	10	21 –22*
8,739	10	3/-	Do. Second Issue 1-8,739....	4	8¼ 9*
10,000	10	6/-	Do. Cum. Pref. 6% 1-10,000..	10	13 13½*
30,111	7	7/-	Gloucester Rail.-Car. & Wagon, Ld., A, 1-29,861 & 49,751-50 000	7	9¼ - 9¾
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 - 4½
14,567	10	1/3	Lancashire Wagon, Ord.	2	2 1/16 2 3/16
4,150	10	5%	Do. do.	10	10½ 10¾
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	41/- 42/6
164,288	1	6d.	Do. Cum. A Pref. 5%, 1-164,288	1	23/6 24/6
235,000	1	7½d.	Do. Cum. B Pref. 6%, 1-235,000	1	27/6 28/6
20,000	20	20/-	Midland Rail.-Car. & Wagon, Ld., 1-20,000	10	19 19½

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM FEBRUARY 13TH TO MARCH 14TH, 1905.

COPPER.



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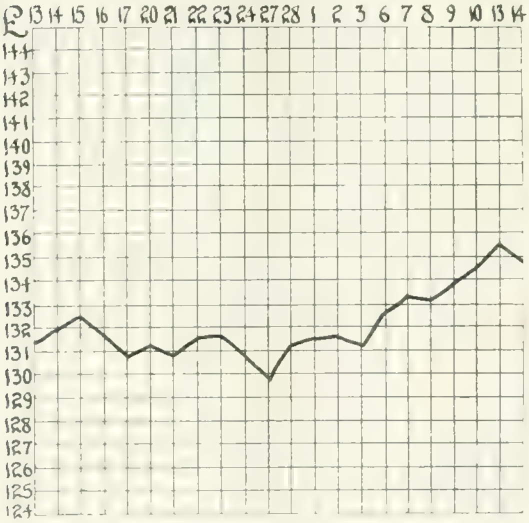
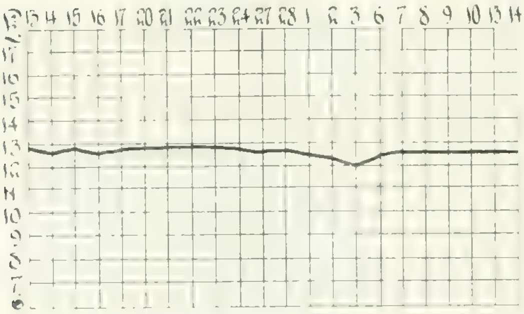
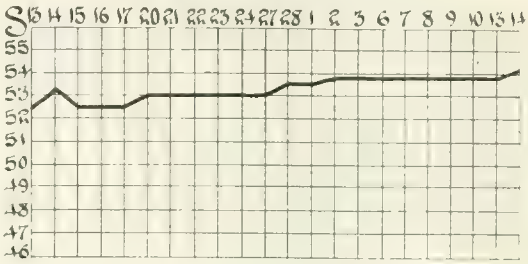


ENGLISH LEAD.



PIG IRON: SCOTCH,



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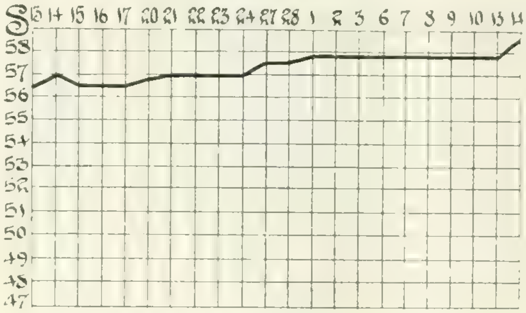
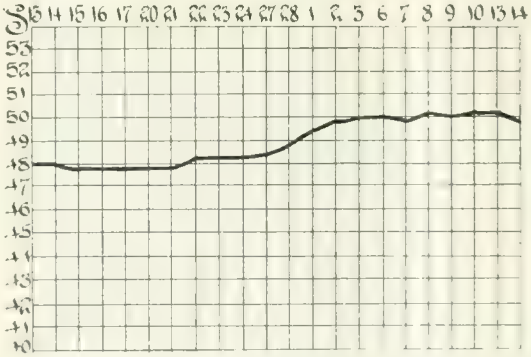
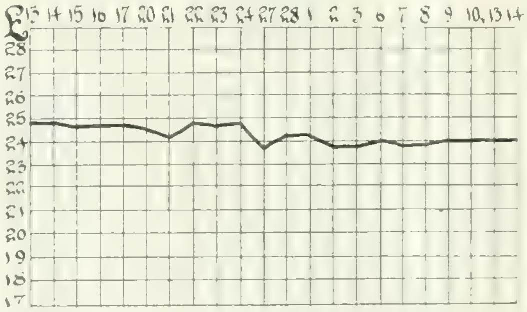


CLEVELAND.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, March 15th, 1905.

COPPER as predicted, has improved, notwithstanding a good deal of selling on each advance. Advices from the United States show the market there to be in a strong position, most producers being well booked for forward delivery, and operators are beginning to realise that the moment is opportune for manipulative tactics. There is no gainsaying the fact that the bear party is growing uneasy owing to the steady support forthcoming for forward metal. Business yesterday was on a fair scale and the market closed at £68 10s. 0d. cash and £68 18s. 9d. three months, and it is quite on the cards that the next few days will see copper touch £70.

The announcement chronicled in our last issue, that the Dutch Government had decided to reduce the quantity of Banca tin, to be offered by auction during the remainder of the year, has had the effect of lifting the price of tin by nearly £4 per ton as compared with the lowest prices of ten days since. It is true that the smaller quantity to be offered at the Banca sales constitutes no great reduction in itself, and it is only when it is viewed in the light of the very small visible supplies, and the constantly increasing consumption that its real significance becomes apparent. America has again sent buying orders into the market, and the quotation closed strong at £135 cash, and £133 7s. 6d. three months.

The Lead market shows a decided improvement, orders having been placed more freely, so that the price which at one time was £11 18s. 6d. for spot metal has advanced Foreign prompt £12 6s. 6d., English £12 7s. 6d.

Spelter has advanced in sympathy with the general upward trend of the metal market, and the final quotations are £24 Ordinaries, and £24 8s. 6d. Specials.

The home iron and steel market continues to be dominated by the American situation, speculators on this side taking their cue from the intelligence which is cabled over. The position is practically unchanged, it still being believed that the present output of pig-iron, notwithstanding that it beats all records, will be insufficient to meet the demand, and on the expectation of exports from this side, the prices of Middlesbrough and other standard brands have risen sharply.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

Steel:

		£	s.	d.
DALZELL ♛♛ STEEL	Siemens' Steel Plates, Marine Boiler Quality	6	15	0
	,, ,, ,, Land ,, ,,	6	17	6
	,, Steel Bars, Boiler Quality	6	17	6
DALZELL ♛ STEEL	Siemens' Steel Plates, Ship Quality Plates	5	17	6
	,, ,, Bars ,, ,,	6	7	6
	,, ,, Angles	5	7	6

Manufactured Iron:

	£	s.	d.
Bars—Dalzell	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):—

	£	s	d.	
Steel Angles (Glasgow ♔ Steel)	5	7	6	per ton.
Steel Ship Plates (Glasgow ♔ Steel)	5	17	6	,,
Steel Bars, Ship Quality (Glasgow ♔ Steel)	6	7	6	,,
Steel Bars, Boiler Quality (Glasgow ♛ ♛ Steel)	6	17	6	,,
Steel Land Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow ♛ ♛ Steel)	6	7	6	,,

Less 5 per cent. discount. Extras as per standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Ironworks, Coatbridge, N.B., quotes:—

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Cable	8	5	0
,, Rivet	6	5	0
,, Best Scrap Rivet	7	5	0

	£	s.	d.
Angles—Phœnix	6	5	0
,, Best	6	15	0
,, Extra Best	7	5	0
Gas Tube Hoops—Phœnix Best	6	15	0
Plates—Phœnix			
,, Best Boiler	7	10	0
,, Best Best Boiler	8	0	0
,, Extra Best Boiler	9	0	0
Boiler Tube Strips Phœnix Best Best	8	0	0

All per ton, delivered f.a.s., Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan. 5 per cent. discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No 1.			No. 3.		
	£	s	d.	£	s.	d.
Coltness, f.a.s. Glasgow	3	4	6	2	14	0
Gartsherrie ,,	2	19	0	2	14	0
Summerlee ,,	2	19	0	2	14	0
Carnbroe ,,	2	16	6	2	12	6
Langloan ,,	3	4	0	2	15	0
Calder ,,	2	19	0	—		
Clyde ,,	2	18	6	2	13	6
Glengarnock, f.o.b. Ardrossan	2	18	0	2	12	6
Eglinton ,, ,,	2	14	6	2	12	6
Dalmellington, ,, Ayr	2	14	6	2	12	6
Shotts ,, Leith	2	19	0	2	14	6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£	s.	d.
W.W. Bars	6	12	6
W.W. Best Bars	7	2	6
W.W. Best Best	7	12	6
W.W. Best Best Best	8	2	6
W.W. Best Shoe	7	2	6
Thornaby	8	2	6
Thornaby Best	8	12	6
Thornaby Best Best	9	12	6
Whitwell Special Admiralty Cable	10	5	0
Special Chain Iron	9	5	0
Tube and Nail Strips	6	15	0
W.W. Angle Iron	6	15	0
W.W. Best Angle Iron	7	5	0
Tee Iron, to 8 inches United	7	12	6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery.

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

		Iron.			Steel.		
		£	s	d.	£	s.	d.
	Bars	6	10	0	7	5	0
	Angles	7	0	0	7	5	0
(BNF)	Tees	7	10	0	7	15	0
	Hoops	7	0	0	7	10	0
W.I.W	Sheets	7	10	0	8	0	0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

	Singles 20 G, 90 in. by 36in. per ton.			Doubles 21 G to 24 G 96in. by 36in. per ton.		
Black Sheets:	£	s.	d.	£	s.	d.
"Vale"	10	0	0	10	10	0
"Shield"	10	10	0	11	10	0
"Severn"	11	10	0	12	10	0
"Baldwin Wilden B."	12	10	0	13	10	0
Charcoal	16	10	0	17	10	0
Best Charcoal	18	10	0	19	10	0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:	£	s.	d.	£	s.	d.
No. 3 Lead	13	10	0	14	10	0
S.V. Lead	15	0	0	16	0	0
No. 3 Terne	15	0	0	16	0	0
S.V. Terne	16	10	0	17	10	0

	Singles [illegible] G to 108 by 36in. per ton.			Doubles 21 to 24 G to 96 by 36in. per ton.		
Tinned Sheets:	£	s.	d.	£	s.	d.
Best Coke (Finish)	28	0	0	29	10	0
,, Charcoal (Finish)	30	0	0	31	10	0
Extra ,, ,,	32	0	0	33	10	0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.

Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.

Extreme sizes in Tin and Patent Coated specially quoted for.

Lattens up to 36 wide by 27 W G. £1 10s. 0d. per ton extra throughout for all brands.

At works less 2½%, for cash monthly, 10th inst.

Galvanized Corrugated Sheets:	£	s.	d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11	12	6	per ton.
"Blackwall" Brand, 26 G., in felt-lined cases for Australia, f.o.b. London	14	5	0	,,

Galvanized Working Up-Sheets:	£	s.	d.	
24 G., f.o.b. London, in Bundles	13	15	0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£	s.	d.	
Crown Bars	6	10	0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7	0	0	,,
Angles	6	15	0	,,
,, Best	7	5	0	,,
T's	7	0	0	,,
,, Best	7	10	0	,,
Best Shoe Iron	8	0	0	,,
,, Rivet Iron	8	0	0	,,
,, Best Rivet (Special)	9	5	0	,,
,, Cable	9	5	0	,,
,, Screwing	8	5	0	,,

	£	s.	d.	
Best Turning	8	0	0	per ton.
,, Plating	8	5	0	,,
Best Best	9	5	0	,,
Treble Best	10	5	0	,,
Plates	7	10	0	,,
Best Plates	8	0	0	,,
,, Boiler Plates	8	10	0	,,
,, Best Boiler Plates	9	10	0	,,
Treble Best Boiler Plates	12	0	0	,,

Delivery f.o.b. Liverpool, Birkenhead or Manchester.

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, steel nails, &c.

Discounts –

45 per cent. off 1-inch to 3-inch strong rose and all fine rose and 6dy. and 8dy. pound.

40 per cent. off 3½ inch to 7-inch strong rose and 10dy. and 20dy. pound.

40 per cent. off all sharp-pointed nails.

Delivered in lots of 4 cwt. and upwards. Extra 2½ per cent. discount off the gross on two tons and upwards.

Steel rose, flat points, 5-inch to 7-inch basis:—
2 tons 9/6 per cwt.
4 cwt. lots and upwards 9/9 per cwt. } d/d any Railway Station.

Steel cut nails, 3-inch basis—
2 tons 8/3 per cwt.
4 cwt. lots 8/6 per cwt. } d/d any Railway Station.
Slit rods (iron) £7 10s. per ton, at works for 2-ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote:—

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18¾ by 14 124s. 110 lb. "BV"	0	12	3
C 20 by 10 225s. 155 ,, "Jumbo"	0	17	3
C 20 by 14 112s. 108 ,, "Lydbrook"	0	12	0
C 28 by 20 112s. 216 ,, "Lydbrook"	1	4	3
Charcoal Tinplates:			
C 20 by 14 112s. 108 lb. "Allaway"	0	12	9

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quotes:—

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

Steel:		£	s.	d	
Blooms	at	3	12	0	per ton.
Billets	at	3	14	0	,,
Sheet Bars	at	3	16	0	,,

Finished Steel:

Bars	at	5	0	0	per ton.
Angles	at	5	1	0	,,
Tees	at	5	4	0	,,
Joists	at	4	10	0	,,
Fencing Standards	at	5	2	0	,,
Shoeing Bars	at	5	4	0	,,
Tyre Bars	at	5	4	0	,,
Half-Round Bars	at	5	5	0	,,
Heavy Rails	at	4	15	0	,,
Light Rails	at	4	17	6	,,

Structural Steelwork:

Prices on application.

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote:—

TIN.

Tin:	£	s.	d.		£	s.	d.	
English Ingots, f.o.b. Dis. 1¼%, & 1%	135	0	0	to	135	10	0	per ton.
English Bars, f.o.b. Dis. 1¼% & 1%	136	0	0	to	136	10	0	,,
Straits G.M B., cash Warehouse, Net	135	2	6	to	135	5	0	,,
Straits G.M.B., 3 months, Warehouse, Net	134	2	6	to	134	5	0	,,
Australian, Mt Bischoff, Warehouse, Net	135	2	6	to	136	2	6	,,

COPPER.

Copper:	£	s.	d.		£	s.	d.	
Standard G.M.B., cash Warehouse, Net	68	15	0	to	68	17	6	per ton.
Standard G.M B., 3 months, Warehouse, Net	69	0	0	to	69	2	6	,,
English, Tough, Cake & Ingot, Warehouses, Net	71	5	0	to	71	15	0	,,
English, Best Select, Warehouse Net	72	10	0	to	73	0	0	,,
English, Sheets and Sheathing, f.o.b., Dis. 2½%	80	0	0	to	80	10	0	,,
English Sheets for India, f.o.b., Dis. 2½%	76	0	0	to	76	10	0	,,
Electro, Warehouse, Net	70	15	0	to	71	0	0	,,
Ore, ex. ship	0	12	0	to	0	13	0	per unit.
Regulus, Matte and Precipitate, ex. ship,	0	13	3	to	0	14	0	,,

YELLOW METAL.

Yellow Metal:	£	s.	d.	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½%				0	0	6¾	per lb.
Sheathing ,, ,,				0	0	6⅞	,,

SPELTER.

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	0	0	to	24	5	0	per ton
Blende of 50% Net	6	11	6	to	6	15	0	,,
Calamine, Net	6	14	0	to	6	15	0	,,

LEAD.

	£	s.	d.		£	s.	d.	
English Pig, Warehouse, Dis. 2½%	12	10	0	to	12	15	0	per ton.
Spanish, ex ship, Dis. 2½%	12	6	3	to	12	7	6	,,
Lead Ore of 70%, Net	6	2	6	to		-		,,

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b, Dis. 2½%	35	10	0	to	36	10	0	per ton.
Ore, 50%, ex ship, Dis. 2½%	8	10	0	to	9	10	0	,,
Crude, ex ship, Dis. 2½%	14	0	0	to	15	0	0	,,

QUICKSILVER.

	£	s.	d	
Spanish, 75 lb., Warehouse, Net	7	12	6	per flask.
Italian ,, ,, ,,	7	11	6	,,

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage —

Upper Main Seam.	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3¼)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (⅜ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:

	s.	d.
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1″ to 2″)	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:

STEAM.	s.	d
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.

HIGH HAZEL.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in. cube	5	6

STEAM.—TOP HARD.		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

		£	s.	d.	
Acids:	Oxalic	0	0	2½	per lb.
	Picric, Crystals	0	0	11	,,
	Tartaric ... at Manchester	0	0	10⅞	,,

		£	s	d.	
Acetate of Lime:	Brown at Manchester net	9	10	0	per ton.
	Grey ,,	11	10	0	,,
Alumina:	Alum, Lump, loose	5	5	0	,,
	,, ,, in casks	5	7	6	,,
	,, Ground, in bags	5	15	0	,,
	Sulphate of Alumina, 14%	4	10	0	,,
Ammonia:	Carbonate	0	0	3⅝	per lb.
	Muriate Grey f.o.b. Liverpool	24	0	0	per ton.
	Sal-ammoniac, Lump, 1sts, del^d. U.K.	42	0	0	,,
	,, ,, 2nds, ,,	40	0	0	,,
	Sulphate ... f.o.b. Liverpool	12	15	0	,,
Arsenic:	Best White Powdered ... net	12	7	6	,,
Bleaching Powder,	35% ... ,,	4	10	0	,,
Borax:	British Refined Crystal ... ,,	12	0	0	,,

Coal Tar Products:

	£	s.	d.	
Benzole, 50/90 % ... ,,	0	0	6	per gal.
,, 90% ... ,,	0	0	7	,,
Carbolic Acid Crystals, 34/35° C. ... ,,	0	0	6	per lb.
,, ,, ,, 39/40 C. ... ,,	0	0	6¼	,,
,, ,, Liquid, 97/99 % ... ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	1	9	,,
Creosote, ordinary good liquid ... ,,	0	0	1¼	,,
Naphtha, Crude, 20 % at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b ,,	0	0	8	,,
,, ,, 95 % at 160° C. ,, ,,	0	0	9	,,
,, ,, 90 % at 190° C. ,, ,,	0	0	10	,,
,, Rectified, flash point over 73° F. ... f.o.b. ,,	0	0	11	,,
,, Rectified, flash point over 100° F. ... f.o.b. ,,		1	0	,,
Naphthalene, all qualities.				
Pitch ... f.a.s. Manchester. ,,	1	11	6	per ton.

		£	s.	d.	
Copperas:	Green, in bulk ... ,,	0	12	6	,,
	,, barrels f.o.b. L'pool ,,	1	19	0	,,
	Cake ... ,,	1	2	6	,,
Copper:	Sulphate	22	0	0	,,
Cyanides:	98% minimum ... f.o.b. net	0	0	7½	per lb.
Lead:	Acetate (Sugar) White, English	27	10	0	per ton.
	,, ,, ,, Foreign c.i.f. U.K	24	5	0	,,
	,, ,, Grey	21	15	0	,,
	,, ,, Brown at Manchester	17	0	0	,,
	Nitrate	24	0	0	,,
	Litharge, Flake	15	10	0	,,
	,, Powder	16	0	0	,,
	Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
	White ,, ,, Dry ,, ,, ,,	16	15	0	,,
Naphtha (Wood):	Miscible, 60 o.p.	0	2	10	per gal.
	Solvent	0	2	7	,,
Potash:	Bichromate ... delivered England ...	0	0	3	per lb.
	Carbonate, 90/92 % ... c.i.f Hull ...	18	10	0	per ton.
	Caustic, 75/80 % ... ,, ,, ...	20	15	0	,,
	Chlorate ... net	0	0	3$\frac{1}{16}$	per lb.
	Montreal ... in Store, Liverpool	35	0	0	per ton.
	Prussiate, Yellow ... net	0	0	5	per lb.

		£	s.	d.	
Soda:	Ash, Caustic, 48 %, Ordinary .. net	5	5	0	per ton.
	,, ,, ,, Refined... .. ,,	6	5	0	,,
	,, Carbonated, 48 % .... ,,	5	10	0	,,
	,, ,, 58 % (Ammonia Alkali) ....net	4	10	0	,,
	,, Bleachers' Refined Caustic 50/52 % .... net	6	10	0	,,
	Caustic, White, 77 % .... ,,	10	10	0	,,
	,, ,, 70 % .... ,,	9	12	6	,,
	,, ,, 60 % .. .. ,,	8	12	6	,,
	,, Cream, 60 % ....,	8	10	0	,,
	Crystals, in bags	3	0	0	,,
	,, barrels	3	7	6	,,
	Acetate .... c.i.f. Hull net	16	15	0	,,
	Bicarbonate, in 1 cwt. kegs...........	6	15	0	,,
	Bichromate......delivered England...	0	0	2¼	per lb.
	Chlorate .... net	0	0	$3\frac{1}{16}$	per lb.
	Nitrate . ex quay Liverpool, ... ,,	11	7	6	per ton.
	Phosphate	9	5	0	,,
	Prussiate ....net	0	0	3⅝	per lb.
	Silicate, Solution, 140° Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)...............	1	12	6	,,
	,, (Saltcake, 95%)...............	1	15	0	,,
Sulphur:	Recovered	4	15	0	,,
	Roll	6	15	0	,,
	Flowers....	7	10	0	,,
Zinc:	Sulphate	6	15	0	,,

MINERALS.

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92%	3	10	0	per ton.
	Sulphate, No. 1, White	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports..........	3	7	6	,,
Manganese:	Lump c.i.f. Liverpool 10¼d. per metallic unit.				
Ochre:	French JC ... . f.o.b. Rouen, net	2	5	0	per ton.
	,, JF	5	10	0	,,
Talc:	(French Chalk).........c.i.f. Liverpool	3	10	0	,,

OILS, etc.

		£	s.	d.	
Aniline Oil	...................................net	0	0	4¾	per lb.
,, **Salt**	.... ,,	0	0	4½	,,
Castor Oil:	French, 1st pressure, f.o.b. Marseilles less 1¼%	22	15	0	per ton.
	English, 1st pressure, f.o.r. Hull, less 2½%	23	5	0	,,
Cocoa Nut Oil:	Ceylon, ex store Manchester...............net	29	10	0	,,
	Cochin, ex store Manchester . ...net	32	0	0	,,
Cotton Seed Oil:	Refined at Hull, less 2½% naked	13	15	0	,,
	Edible...at Hull, less 2½% naked	14	5	0	,,
Glycerine:	Crude, 80% .... net	31	0	0	,,
Linseed Oil:	Raw... ..at Hull, less 2½% naked	13	17	6	,,
	Boiled......at Hull less 2½% naked	14	17	6	,,
Starch:	American Pearl...at Manchester, net	8	15	0	,,
	Dextrine.... .... ,, ,,	17	15	0	,,
	Farina............... ,, ,,	15	0	0	,,
Shellac:	Standard TN orange spot	147/-			per cwt.
Turpentine:	American.........at Liverpool	38	0	0	per ton.
	Russian ....at Hull...net	19	0	0	,,

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:—

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to	0	3	0
Quebec Waney Board Pine...	,,	0	2	8		0	3	9
St. John Pine, 18 in. average	,,	0	2	4		0	3	3
Lower Ports Pine	,,	0	1	3		0	1	8
Quebec Red Pine	,,	0	1	6		0	2	0
Quebec Oak, 1st quality	,,	0	2	9		0	3	4
Quebec Oak, 2nd quality ...	,,	0	1	6		0	2	6
Ash	,,	0	1	6		0	2	3
Elm	,,	0	3	3		0	3	10
Hickory	,,	0	2	0		0	2	6
Quebec Birch	,,	0	1	6		0	2	3
St. John Birch	,,	0	1	6		0	2	0
Birch Planks....................	,,	0	0	9		0	0	11
Spruce Spars	,,	0	0	10		0	1	0

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine	per std.	22	10	0	to	32	10	0
2nd do. do.	,,	17	0	0		22	0	0
3rd do. do	,,	11	10	0		13	0	0
St. John, N.B., etc., Spruce	,,	6	15	0		7	5	0
Lower Ports Spruce..	,,	6	10	0		6	15	0
Spruce Boards................	,,	5	10	0		6	0	0

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s.	d.		£	s.	d.
Hewn	per cub. ft.	0	1	4	to	0	1	8
Sawn	,,	0	0	11		0	1	6
Planks, Stowage	,,	0	0	10		0	1	0
Boards, Prime	per std.	12	10	0		16	0	0
Oak Timber	per cub. ft.	0	1	6		0	2	6
Oak Planks	,,	0	1	6		0	2	1
East India Teak..............	per load	12	0	0		16	0	0
Greenheart.....	,,	6	15	0		7	10	0

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	6	to	0	2	0
Dantzic and Memel Fir, Crown	,,	0	2	1		0	2	6
Dantzic and Memel Fir, Middling	,,	0	1	9		0	1	11
Stettin	,,	0	1	9		0	1	11
Swedish	,,	0	1	0		0	1	3
Riga Whitewood	,,	0	1	0		0	1	3
Norway Mining Timber	,,	0	0	9		0	1	0
Dantzic and Stettin, etc., Oak..	,,	0	2	6		0	3	0
Norway Spars.................	,,	0	1	2		0	1	9

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality	per std.	19	0	0		20	0	0
Red Archangel and Onega, 2nd quality	,,	14	0	0		16	0	0
Red Archangel and Onega, 3rd quality	,,	10	10	0		12	10	0
St. Petersburg, 1st quality...	,,	16	0	0		17	10	0
Do. 2nd ,, ...	,,	14	0	0		15	0	0
Gefle	,,	11	10	0		16	0	0
Wyburg	,,	11	0	0		12	10	0
Uleaborg	,,	10	0	0		12	10	0
Gothenburg	,,	11	0	0		16	0	0

SELECTED PATENTS.

Compiled expressly for this journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C., at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

4011. J. Haviland, F. H. Haviland, and J. Farmer, Glasgow. Feb. 27th. Improvements in and relating to appliances for elevating and discharging or conveying grain and the like

4012. W. G. Tilbrook, Glasgow. Feb. 27th Levering signal for railways.

4017. R. C. Harse, Dowlais. Feb 27th.—Improvements in or relating to extensible belts or straps.

4019. E. C. Wade, Lewes. Feb 27th—An improvement in wheels.

4024. J. E. King, Leeds. Feb. 27th.—An improved metallic packing

4029. J. Derbyshire and Co., Derbyshire, Stanley. Feb. 27th —Improvements in pedestals or bearings for colliery corves, tubs, wagons, or the like.

4038. M. Doyle and R. J. O'Neill, London. Feb. 27th Improvements in smoke consumers

4039. M. M. Friedlaender, London. Feb. 27th.—Improvements in engine machinery and the like centrifugal governers.

4053. H. B Walda, London. Feb. 27th Improvements in rotary engines.

4056. H. E. Newton, London. Feb 27th —Improvements in internal combustion engines. (*The International Steam Pump Co., U.S.A.*)

4059. J. M. Chambers, London. Feb. 27th.—An improved ventilator.

4068. H. Lentz, London. Feb. 27th.—Valve operating mechanism for steam engines and the like

4074. The Hoffman Manufacturing Co., Ltd., and W. B. Mair, London. Feb 27th –Improvements in thrust bearings for propeller shafts and like rotating parts.

4080. O. Imray, London. Feb. 27th.—Improvements in rotary rock drilling machines. (*Siemens-Schuckertwerke G. m. b H Germany.*)

4087. F. Sellers F. G. Wallace, and C. Capel, London. Feb 27th.—Improvements in or relating to gas generating plant for internal combustion engines.

4093. F. H. Brenton and J. Struthers, London. Feb 27th.—Improvements in cribbing or shoring for excavations

4094. E. Baville, London. Feb. 27th.—Improvements in and relating to tool holders for machine tools. (Date applied for February 27th, 1904.)

4098. J. Johnston, and H. W. Buddicom, London. Feb 27th —Improvements in variable speed gear

4110. F. Wilkinson and C. Collinge, Rochdale. Feb 28th — Improved locking arrangement for fish bolt nuts.

4111. H B. Horne, Gateshead-on-Tyne. Feb 28th — Improvements in apparatus for distributing steam or other actuating fluid in fluid-pressure engines or motors.

4114. J. H. Boylan, Manchester. Feb. 28th —Improvements in tubes for steam generators, superheaters, feedwater heaters, and economisers.

4115. J. H. Boylan, Manchester. Feb. 28th.—Improvements in tubes for steam generators, superheaters, feedwater-heaters, and economisers

4142. C. Walton, London. Feb. 28th.—Improvements in and relating to boring machines for rock, coal, or other material

4151. H. Kochheim, E. Kochheim, and G. Reuter, London. Feb 28th – Improvements in and relating to steam boilers

4175. T M. Down and A. Marchant, London. Feb 28th. Improvements in stocks and dies for cutting screw threads.

4176 S. S. Aburn and F. W. Mason, London. Feb. 28th.—Improvements relating to lock-nuts.

4182. W. B. Hardy, London. Feb. 28th.—Improvements in and relating to the prevention and removal of incrustation and corrosion in steam generators, water heating pipes and the like

4185. A. Brander, London. Feb. 28th.—Improved reversing rotary valves for steam engines

4188. J. H. K. McCollum, and J. W. L. Forster, London. Feb 28th Improvements in fluid turbine engines

4193. H. S. Scott and H. F. Tyzack, London. Feb 28th —Improvements relating to turbines

4196. O. Briede, London. Feb. 28th.—Improvements in or relating to the manufacture of rivets, bolts, and the like. (Date applied for, March 1st, 1904.)

4197. B. W. Head, London. Feb 28th –Improvements in apparatus for use in charging open hearth furnaces and the like

4219. G. Quick, Bournemouth. March 1st Improvements in screw propellers.

4231. N. S. Arthur and J. S. Binnie, Glasgow. March 1st - Improvements in and connected with the fire grates of steam boilers and other furnaces

4235. W. James, Chester. March 1st.—Improvements in or appertaining to appliances for removing and replacing the piston rings of internal combustion engines or the like.

4248. S. E. Alley and D. H. Simpson, Glasgow. March 1st Improvements in and relating to steam engines.

4252. G. Dawson and W. A. Dawson, Kingston-upon-Hull. March 1st –Improvements in drilling and boring heads to be applied to drilling and boring machinery, hand tools and the like

4277. J Cowan, London. March 1st.—Improvements in and relating to water-tube boilers.

4284. H. T. Wright, London. March 1st.—Improvements in connection with turbines driven by power generated by internal combustion.

4293. C. Casals, London. March 1st – New or improved fire bar.

4297. W. M. Bowron, London. March 1st.—Method and means for producing (irrespective of the power applied) different speed in one direction from that in the opposite direction of the piston or plunger of reciprocating engines or pumps, or the like.

4309. H. R. Buddenborg, London. March 1st.—Improvements in or relating to pumps, and especially pumps for liquids containing more or less granular material (*The General Construction Co., U.S.A.*)

4309. F. E. Reed, Kingston-on-Thames. March 2nd.—Improvements in pressure regulators for force pumps.

4358. C. C. Lewis, London. March 2nd.—Improvements in turbines for elastic fluids.

4396. J. P. Lowson, Manchester. March 3rd.—Improvements in steam superheaters.

4398 C. Willetts, jun., and A. H. Rothan, Birmingham. March 3rd Improvements in worm and worm wheel pulley blocks, hoists, lifts, and the like.

4400. J. Hamilton, Glasgow. March 3rd.—Improvements in the arrangement of turbine propelling machinery on shipboard.

4407. J. S. D. Shanks and A. W. Metcalfe, Belfast. March 3rd.—Improvements in pressure generators for driving engines and the like.

4411. N. MacNicoll, Rutherglen. March 3rd.—Improvements in steam boilers.

4416. R. Anderton, Halifax. March 3rd.—Improvements in steam superheaters.

4460. H. Sleep and B. Solomon, London. March 3rd.—An improvement connected with taps or cocks.

4461. H. Sleep and B. Solomon, London. March 3rd.—An improvement in taps or cocks

4465. D. Luigi, London. March 3rd.—Improvements in and connected with water and like taps.

4475. M. M. Dessau, London. March 3rd.—Improvements in and relating to rolling tube packings.

4476. The Warwick Machinery Co., Ltd., London. March 3rd.—Improvements in and relating to elastic fluid turbines. (*The General Electric Co., U.S.A.*)

4491. D. Muckley and A. Payne, Warrington. March 4th.—An improved drum for winding or coiling wire rope—copper, iron, or steel—electric cable, lead tube, hemp, or cotton rope.

4511. W. Rowbotham, Birmingham. March 4th.—Improvements in gas, oil, and like engines.

4516. C. Tuckfield and W. G. de F. Garland, East Molesey. March 4th.—An improved apparatus for propelling ships, vehicles, and other purposes.

4528. The Haste Pump Co., Ltd., and J. M. Hewitt, London. March 4th.—Improvements in pumps.

4540. The Elektrizitats-Actien-Ges., vormals W. Lahmeyer and Co., London. March 4th.—Improved means for alternately driving from a reciprocating engine and a rotary engine. (*Date applied for, March 4th*, 1904.)

4559. The Tangye Tool and Electric Co., Ltd., and C. Pendlebury, London. March 4th.—Improvements in lathes for turning railway carriage and other axles.

4563. S. Turton, London. March 4th.—Improvements in and relating to brickwork for boiler setting, and for similar purposes.

4569. C. H. Read and E. Jones, London. March 4th.—New or improved water bridge or arch for the furnaces of steam generators.

4574. R. H. Rice, London. March 4th.—Improvements in shaft bearings. (Date applied for, March 4th, 1904.)

RECENT SPECIFICATIONS.

ELECTRICAL RECEIVING APPARATUS.

J. T. Armstrong and A. Orling, of London. Jan. 27th, 1904.—This invention relates to the arrangement of electro-capillary receiving apparatus, and has for its object improvements whereby transient and other currents or disturbances occurring in the line or other circuit, or part thereof, may be obviated or discharged without disturbing or interfering with the proper working of such apparatus. The object of the invention is to overcome the difficulties of stray currents, or other disturbances, for instant constantly varying potential. A shunt is employed through which such disturbances may find relief. According to one arrangement a variable resistance is used which may or may not be inductive, which is connected up in the place of the usual receiving apparatus, so that the cable and the earth, or other equivalent parts which constitute electro-static capacities, may discharge through it. To this variable resistance the terminals of the electro-capacity apparatus are connected at points of suitable potential difference. Instead of this arrangement an induction coil or transformer may be employed, the primary of which takes the place of the variable resistance referred to in the arrangement first described while the receiving apparatus is connected to the terminals of the secondary coil, which may also be provided with a suitable shunt.

Fig 1

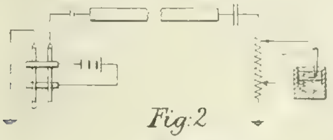


Fig 2

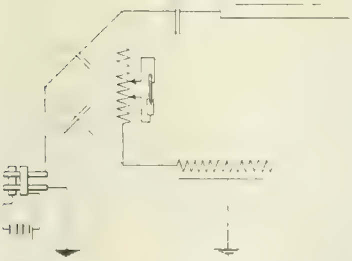


Fig 3

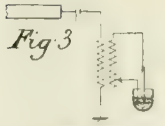
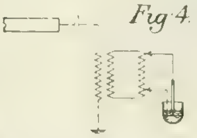


Fig 4



STOP VALVES.

J. Hopkinson and Co., Ltd., J. Hopkinson, and R. Kilburn, of Huddersfield. April 2nd, 1904.—Relates to parallel slide stop valves of the kind in which the valve discs are pressed against their faces by a spring and this invention has for its chief object the provision of improved means for maintaining the substantial parallelism of the valve discs when opening and closing the valve. According to one form of this invention, the back of each valve disc is provided with a projection, or groove, and the inner end of the valve spindle is also furnished with a groove or projection, on both sides, to engage with the projections or grooves on the discs, for the purpose of operating the discs to open and shut the valve. To retain the substantial parallelism of the valve discs, two or more retainers are provided, having ears or projections at the sides to hold the discs, and to prevent the latter from being moved apart by the action of the spring when the valve is open, while not interfering with the pressing of the discs against their seats when the valve is shut. To allow of fixing the valve on its side without straining the spindle, or unduly wearing the stuffing-box through which the spindle passes a ring is provided enclosing the spring between the discs, and an annular projection from each disc, and having ears at the sides adapted to rest on the valve body, and support the weight of the discs. To prevent rotation of the ring, the latter is furnished with a pin or projection, or with lugs or ears engaging with the inner end of the valve spindle. The drawings illustrate one form of the invention, and detailed views of the retainer for preventing undue spreading of the valve discs.

Fig 1

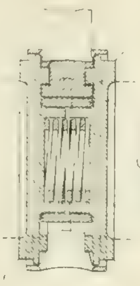


Fig 2

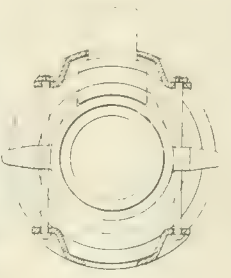


Fig 3

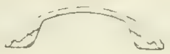


Fig 4

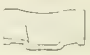
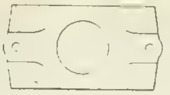


Fig 5



AUTOMATIC REGULATING APPARATUS FOR BOILER AND THE LIKE.

H. B. Kershaw, of Stalybridge. March 26th, 1904. This invention is designed to provide an improved automatic regulating apparatus for controlling the dampers of steam and hot-water boilers, for regulating the steam or other supply to heaters, coolers, calorifiers, radiators, and the like, for governing pumps, pumping hot water, and for similar purposes. A hollow bulb is placed in the boiler pipe, tank, or the like, the temperature in which it is desired to maintain constant, or with regard to which it is desired to govern the damper, valve, or the like. This bulb is connected with a suitable piston or ram, preferably placed externally to the pipe, tank, or like, which is pivoted to a lever suitably fulcrummed, so that the movement of the lever by the piston or ram will give an increased movement at the other end of the lever, which is connected with the damper, valve or like, which it is desired to regulate in any convenient way. A spring or weight is provided to return the lever and ram to normal position. To actuate the ram any suitable liquid expansible on an increase in temperature is placed in the bulb, a suitable filling hole with plug being provided for the purpose, preferably externally of the pipe, tank, etc., which, on any increase in the temperature round the bulb, increases in volume and presses against the piston or ram, causing it to move outwards and actuate the lever or other device, which regulates the damper, valve or other governor as desired.

NEW PUBLICATIONS.

"MECHANISM."

By S. Dunkerley, M.Sc., A.M.Inst.C.E., M.I.Mech.E. Longmans, Green and Co. 9s. net.

Professor Dunkerley's elementary treatise on the kinematics of machines is the outcome of his many years' experience acquired in lecturing on the subject at the Universities of Cambridge and Liverpool, and at the Royal Naval College, Greenwich. The writer's intimate knowledge of students' requirements fits him admirably for the authorship of this work, which was specially designed for their use. The introductory section describes in detail various machine tools and mechanism required for special purposes. Then follows a complete account of straight line motions, couplings, velocity diagrams, approximate solutions to link motions and radial valve gears, acceleration diagrams, toothed wheels, non-circular wheels, cams, and machines for cutting teeth. The book is well got up, the illustrations excellent, and the student who makes a careful study of this work will be assured of a solid grounding in the fundamental principles of applied mechanics.

"GERMAN TECHNICAL WORDS AND PHRASES."

An English-German and German-English Dictionary of technical and business terms and phrases, used in commerce, arts, sciences, professions and trades. By C. A. Thimm, F.R.G.S., and W. von Knoblauch. E. Marlborough and Co. Cloth, 2s. 6d. Leather, 3s. 6d.

This is a companion volume to "French Technical Words and Phrases," and is an excellent attempt to collect, within the compass of a pocket volume, technical terms and phrases such as are passed over by the ordinary lexicographer. Roman type is employed throughout, and there is a useful appendix with tables of money, weights and measures. We understand that a similar volume of Italian technical terms is in preparation and have little doubt but that the series will be readily taken up by business men. Of course, in a miscellaneous collection of technical terms, it would be easy to point out omissions, but the publishers welcome suggestions and the utility of future editions should be greatly enhanced by the co-operation of readers and users. In the meantime we think that every business man who is in touch with Germany, will find it worth while to possess a copy of "German Technical Words and Phrases."

"SELL'S DIRECTORY OF REGISTERED TELEGRAPHIC ADDRESSES,

And National List of Large Commercial Houses, and Buyers' Guide, 1905." Price (including three supplements issued quarterly), 21s. Henry Sell, 166, Fleet Street, London, E.C.

To manufacturers and traders of every description this compilation, holding as it does a unique position among the many "annuals," is quite indispensable. With the present issue, the work which has been carefully revised, reaches its twentieth year of publication. Firms interested in exporting industries will find the new feature—an authentic list of British Consuls abroad—of great assistance.

We have also received "Estimating for Builders' Work" and "Measuring Builders' Work." Mechanic's Manuals, edited by Paul N. Hasluck. (Cassell and Co. 6d. net.) The two latest additions to this well-known series contain in a convenient form, a comprehensive digest of the data of these subjects scattered over eighteen volumes of the "Building World."

BOOKS RECEIVED.

"The Home Mechanic." By John Wright. John Murray. 6s net.

"Ordinary Foundations, including the Coffer-dam Process for Piers. By Charles Evan Fowler. Chapman and Hall.

"Science and Hypothesis." By H. Poincaré. Walter Scott Publishing Company Ltd. 3s 6d.

NEW CATALOGUES.

The Mitcham Motor Company, of Cowes, Isle of Wight, have issued a catalogue of marine motors and launches with numerous illustrations and line drawings.

Messrs. Burnham, Williams and Co., Philadelphia, Pa., U.S.A. Booklet No. 48 is a record of recent construction by the Baldwin Locomotive Works. The locomotives illustrated show to full advantage on a slightly tinted ground with a red border line, while the general dimensions are given on the opposite pages in English and French.

Blue Asbestos, as mined in Cape Colony by the Cape Asbestos Company, Ltd., is the subject of a handsome publication issued by this firm. It is claimed that the Cape Blue Asbestos is the most efficient material extant for coverings on account of the natural high non-conducting qualities it possesses, and also because it remains unaffected by atmospheric influences, is neutral, resilient, strong, and light in weight. Many interesting blocks illustrate the application of these coverings to boilers and pipes, etc. Attention is also drawn to asbestos packings, cloth, curtains, rope and cord, thread and yarns, paper, felt, etc., and lists and illustrations are included of vessels of many nations which have been supplied with this material by the company.

Messrs. W. and T. Avery, Ltd., of Soho Foundry, Birmingham, forward Sheet No. 89, drawing attention to their patent weighbridges, specially designed for public use to print the weights on tickets and also to count the number of loads weighed. Sheet No. 150 illustrates the firm's special "Motor-Wagon" weighbridge, for weighing motor-wagons and trailers.

An illustrated price list of Albion cars has been issued by the Albion Motor Car Company, Ltd., of South Street, Scotstoun, Glasgow. Excellent half-tone illustrations are included, as well as some press notices and testimonials from owners of Albion cars.

The Preliminary List, 1905, of the "Duryea" Power Carriages, which we note are British built throughout, has been issued by the Duryea Company Ltd., of Duryea Works, Widdrington-road, Coventry.

The General Electric Company, Ltd., 71, Queen Victoria Street, E.C. A finely printed catalogue with a striking blue and gilt cover has just been issued by this company, dealing with their "Witton" continuous current motors, open protected, semi-enclosed, enclosed ventilated, and totally enclosed types. It is interesting to note that the motors in question have been entirely remodelled. The design of the bearings is such that the motors can be fixed on a horizontal base, a vertical wall, or overhead. All parts are made to gauge and strictly interchangeable. Measurements are given both in inches and centimetres, and weights in lbs. and kilos. There is also some very instructive information as to the approximate power required to drive various classes of machinery. Altogether it will be seen that great pains have been taken to make the catalogue thoroughly up-to-date and of the greatest utility to manufacturers in search of motors.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, MAR. 17.—National Physical Laboratory: Presentation of Report, 3 p.m.—Institution of Mechanical Engineers, Storey's Gate, 8 p.m. Paper, "First Report to Steam Engine Research Committee," Professor David S. Capper.—North-East Coast Institution of Engineers and Shipbuilders.

SATURDAY, MAR. 18.—Agricultural Hall Motor Show opens. Glasgow Technical College Scientific Society: Paper, "Independent Condensing Plant," Mr. Charles Day, 7.30 p.m.

MONDAY, MAR. 20.—Society of Arts: Second Cantor Lecture, "Telephony," Mr. H. Laws Webb, 8 p.m. Institute of Marine Engineers, 8 p.m.

TUESDAY, MAR. 21.—Royal Institution, Albemarle Street: Professor Dalby on "Engineering Problems," 5 p.m.—Institution of Civil Engineers.

WEDNESDAY, MAR. 22.—Liverpool Engineering Society: Paper "Electric Traction on Main Line Railways."—Geological Society, 8 p.m.—Society of Arts, Ordinary Meeting.

THURSDAY, MAR. 23.—Royal Society, Ordinary Meeting, 4.30 p.m.—Institution of Electrical Engineers, Great George Street: Discussion on Papers read at the previous meeting.

FRIDAY, MAR. 24.—Physical Society, 5 p.m. Electro-Harmonic Smoker.—Royal Institution: Sir Oliver Lodge, "A Pertinaceous Current," 9 p.m.

PAGE'S WEEKLY Miscellaneous

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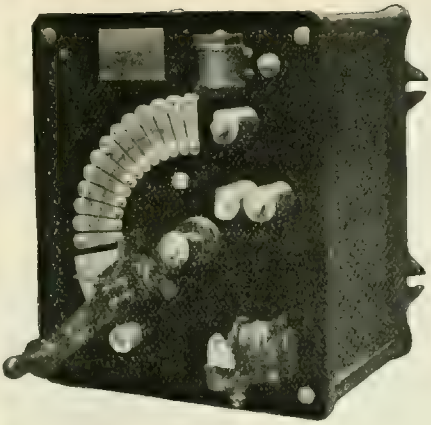

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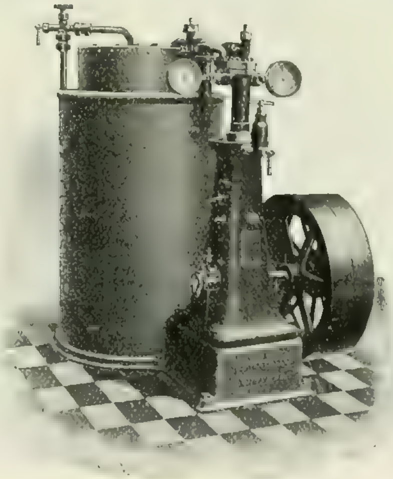

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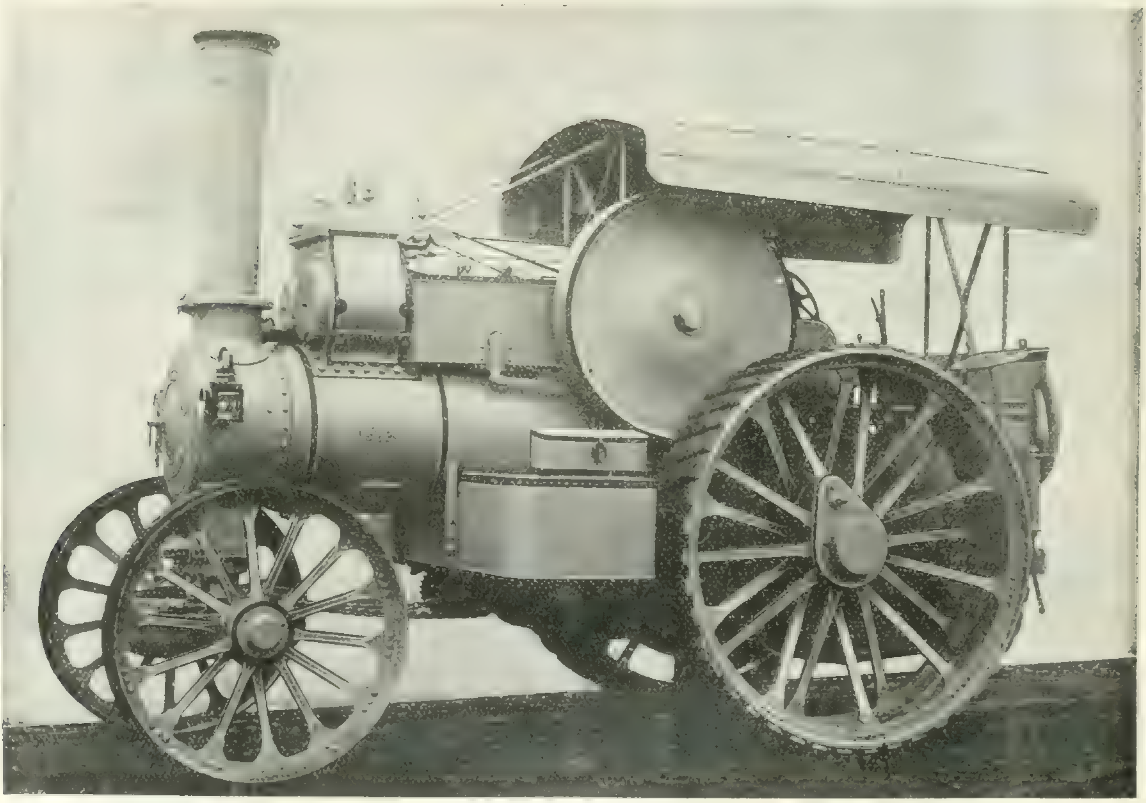

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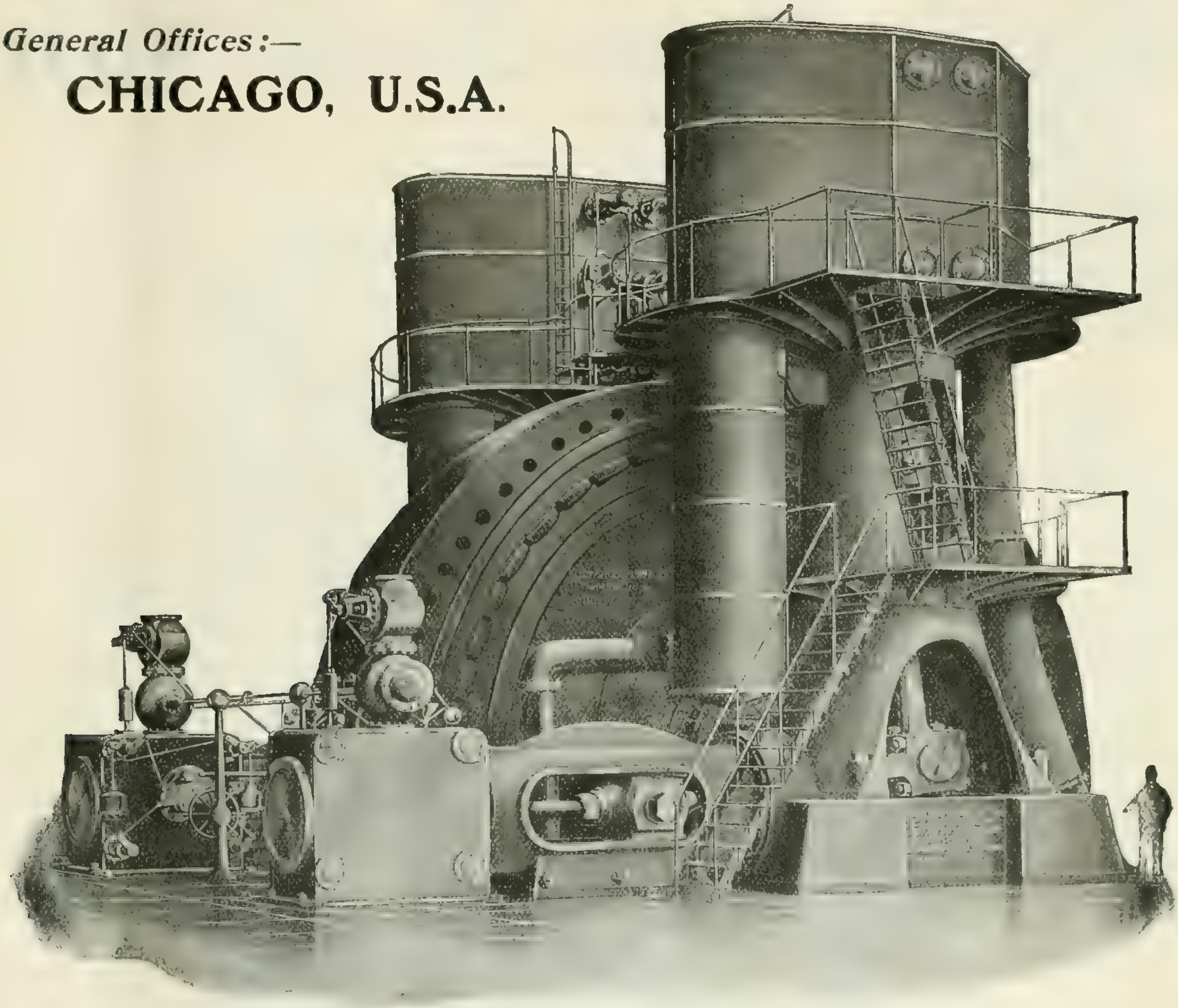

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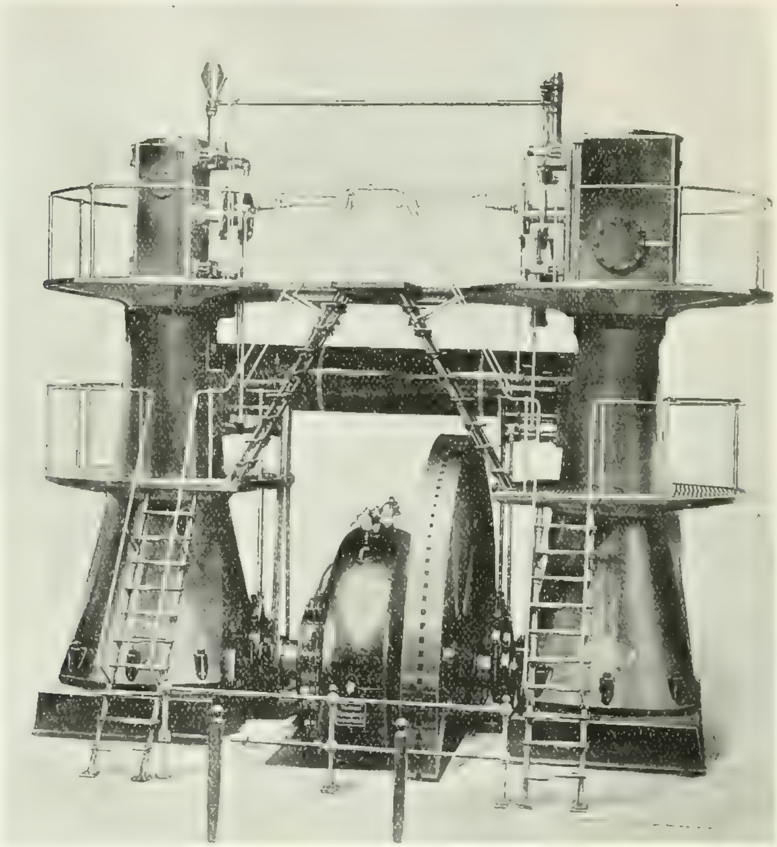

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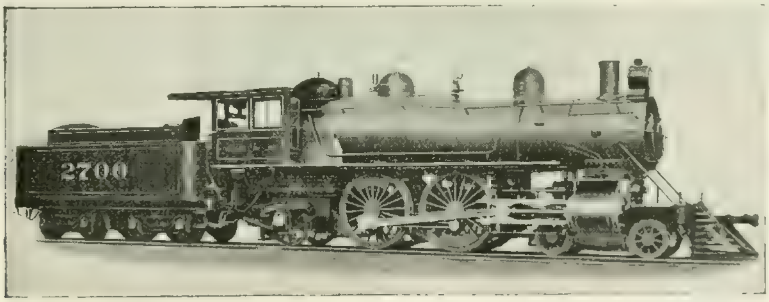

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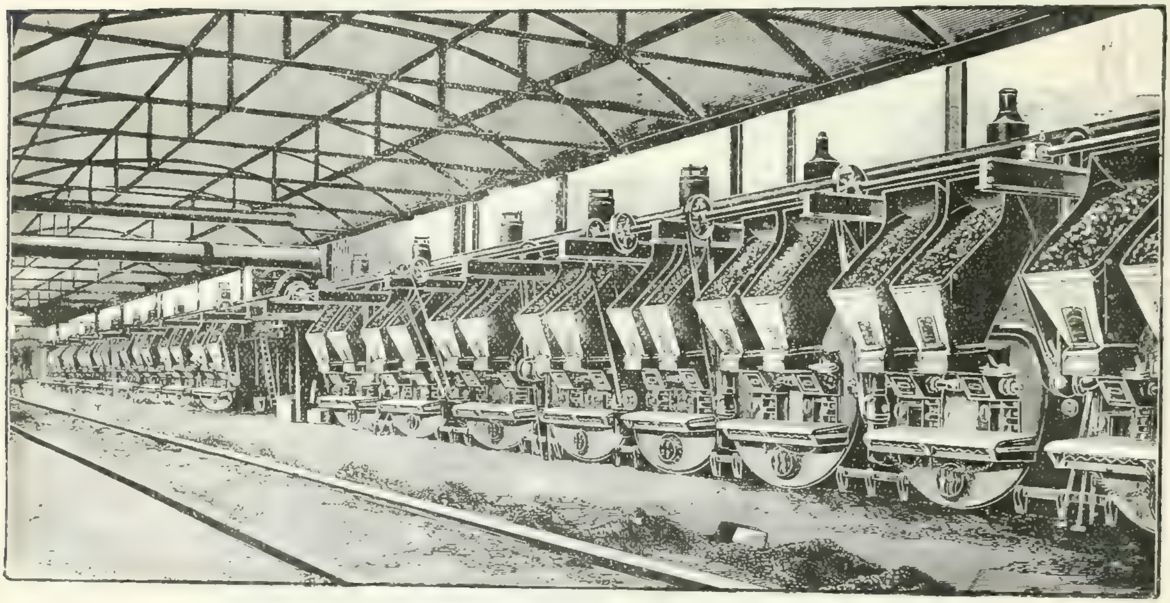

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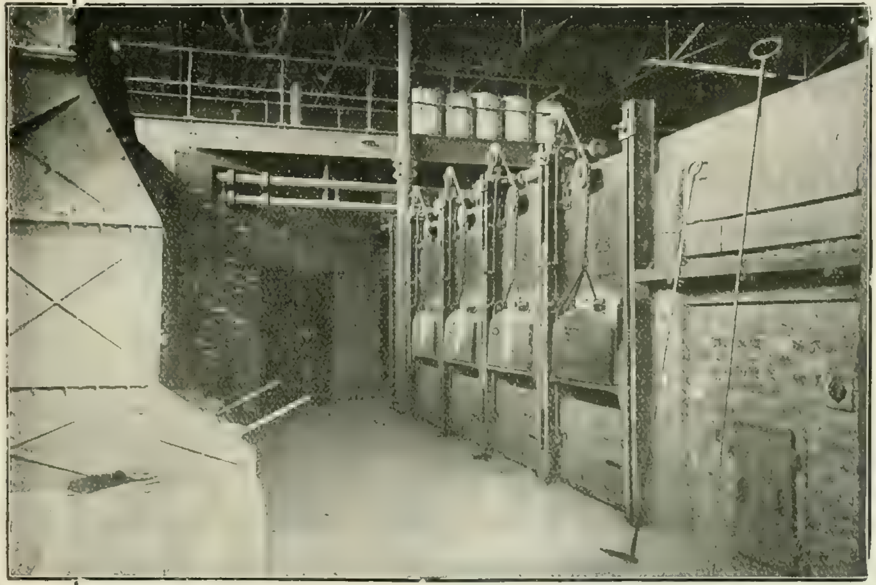

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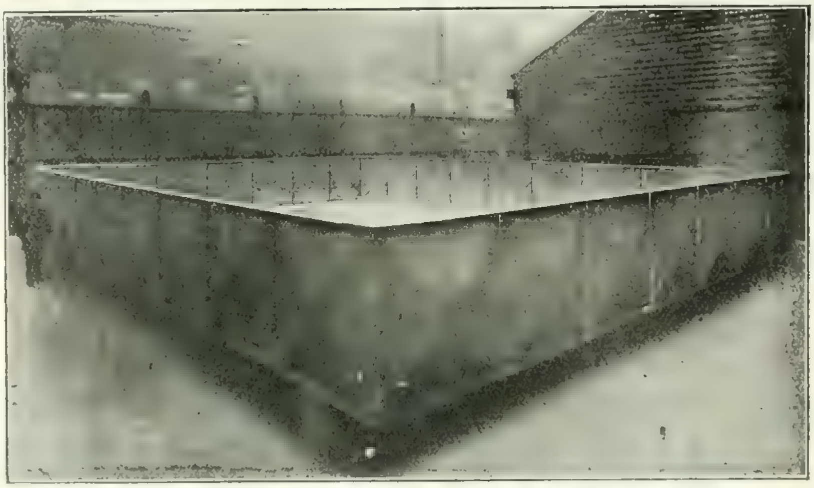

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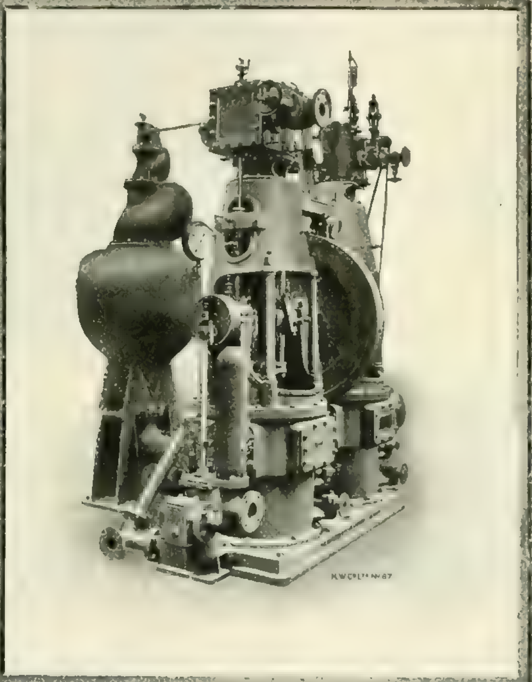

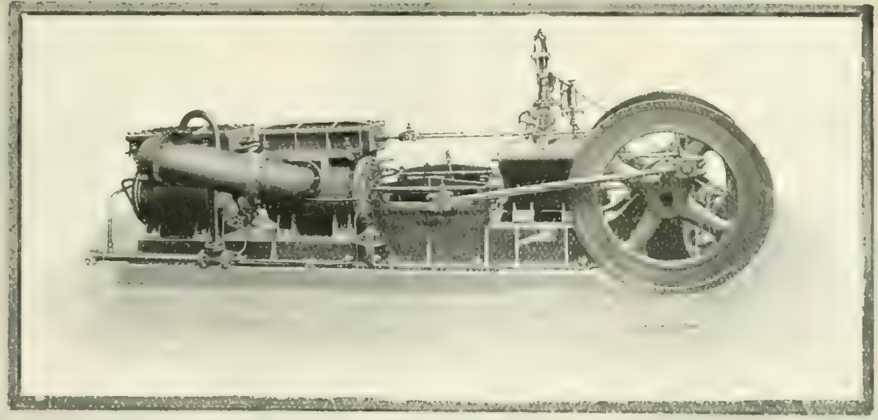

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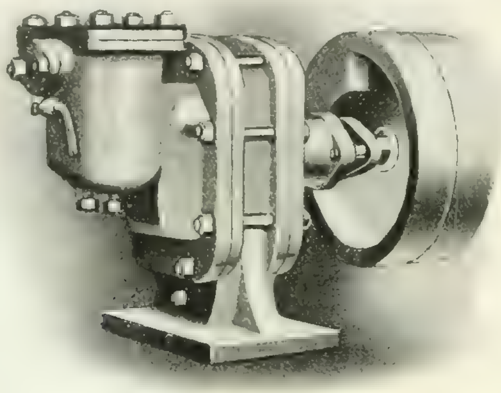

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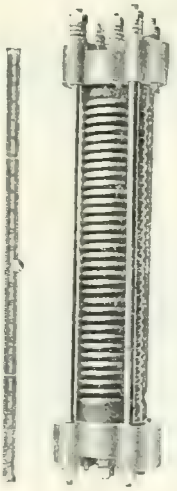

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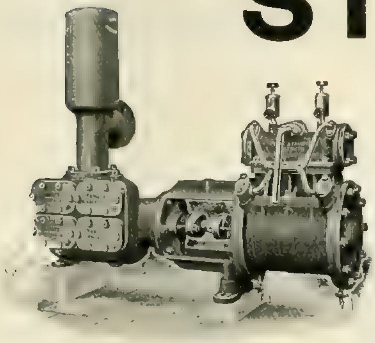

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Electrically Driven Pumps
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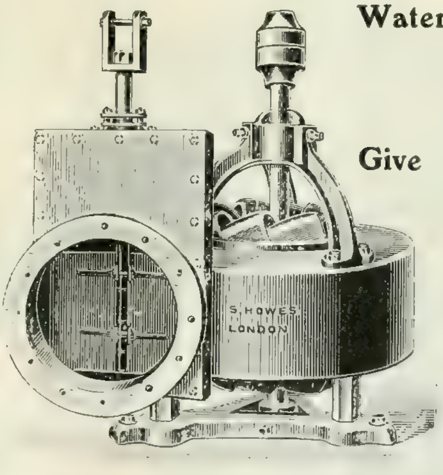
"Little Giant" Turbines.



Water Wheels, Water Motors, and Pelton Wheels.
Simplest to Operate.
Cheapest to Erect and Maintain.
Give Greatest Efficiency. Cheapest to Buy.
Require Smallest Amount of Water.

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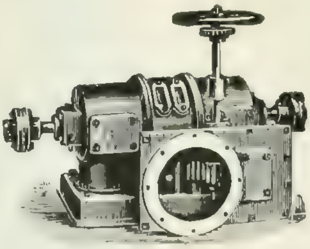

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MOST SUITABLE AND MOST ECONOMICAL PUMPS FOR ALL ELECTRICAL AND INDUSTRIAL SERVICES.

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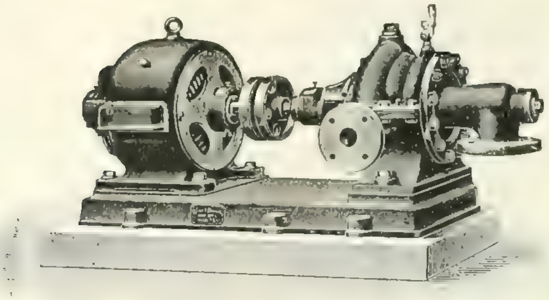

Made for any capacity, for all lifts, with highest efficiency, specially for direct coupling with Electromotors, also high-speed Electrical Plunger-Pumps for all services.

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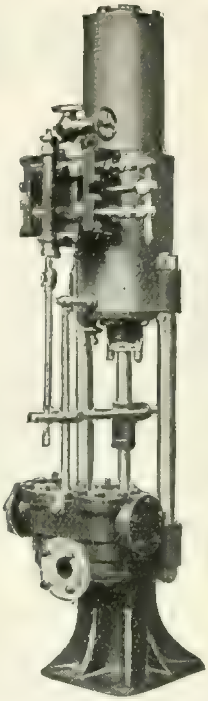

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ECONOMICAL AND EFFICIENT.

We deliver 100 lbs. of Water for the expenditure of 1 lb. of Steam. This with our 2,000 gallon Pump, and a much higher efficiency as the size of the Pump increases.

AN IDEAL PUMP FOR GENERAL BOILER FEEDING PURPOSES.

APPLY FOR PARTICULARS.

"SIROCCO" FANS

FOR

INDUCED DRAFT.

"Sirocco" Induced Draft Fans are now in use at the following Electricity Stations:—

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Do. (Uxbridge)
Newcastle-on-Tyne (Neptune Bank)
Do. (Carville Station).
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Rothesay.
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Stockport.
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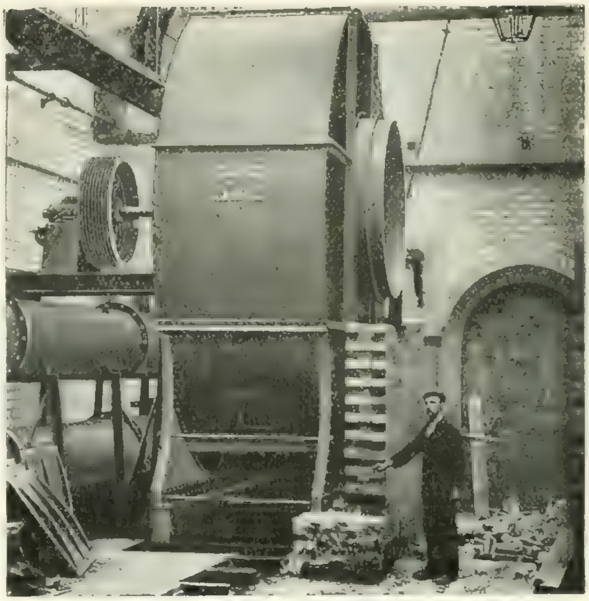

7ft 6in diameter "Sirocco" Induced Draft Fan, in course of erection at Port Dundas Electric Light Station.

"A Fan can be run for about one-tenth of the power represented by the waste heat required to command a good draft in a brick chimney."

Highest Award, Grand Prize, St. Louis Exposition, 1904.

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PAGE'S WEEKLY Electrical Apparatus

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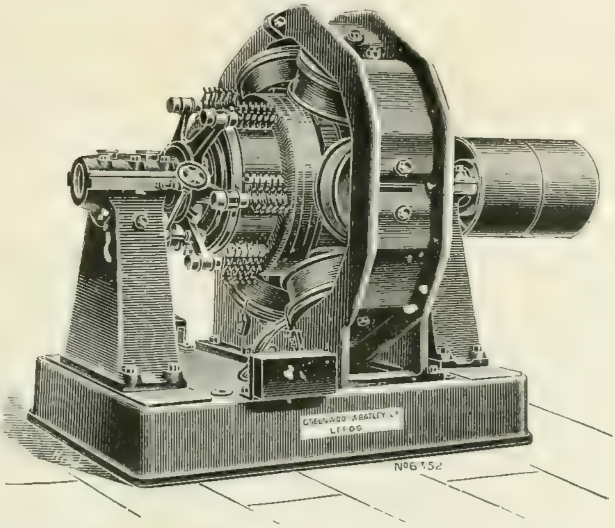

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Dynamos and Motors, Complete Electrical Installations.

BRITISH MAKE THROUGHOUT.

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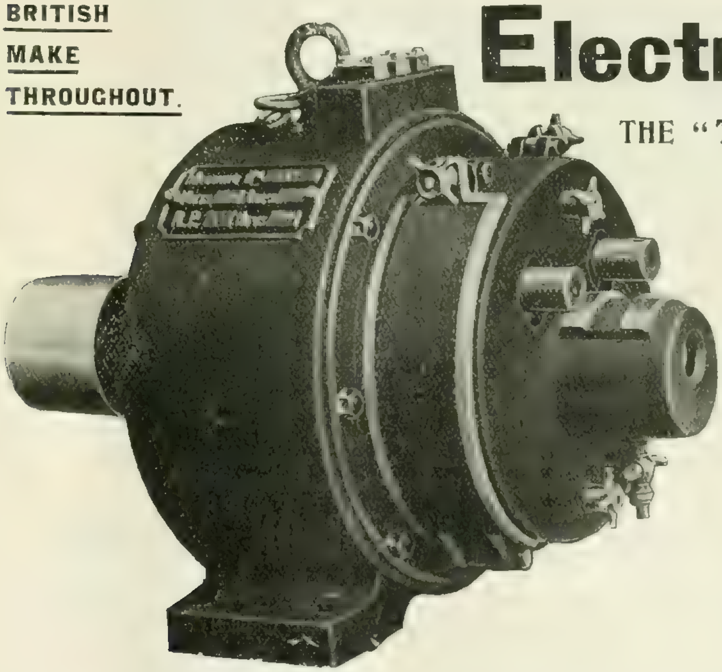

Simple Mechanical Construction.

Low Temperature Rise.

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STANDARD SIZES—

½ h.p. to 40 h.p.

Further particulars on application.

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WHILST OUR PRICES ARE EXCEEDINGLY LOW. Write for Particulars.

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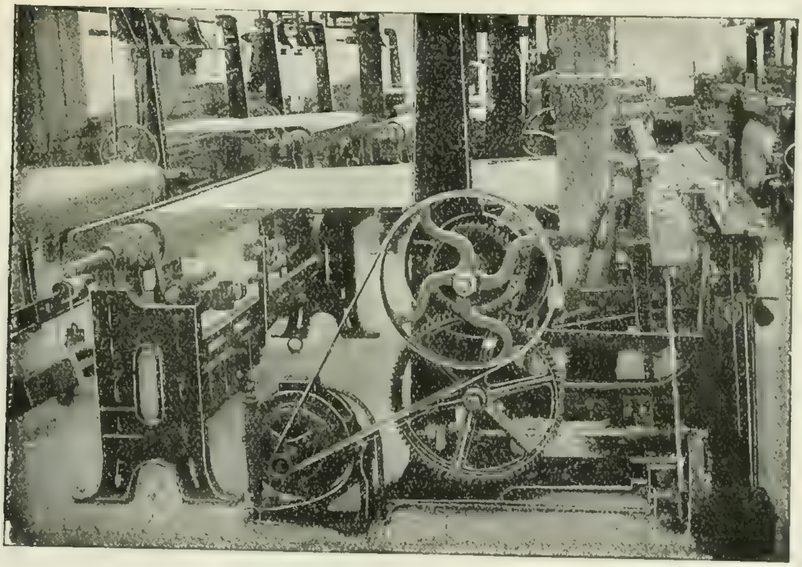

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Continuous Current ★ Threephase Current

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Yearly Output 12 000 Dynamos and Motors equal to 170 000 000 Watts
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XI. 30

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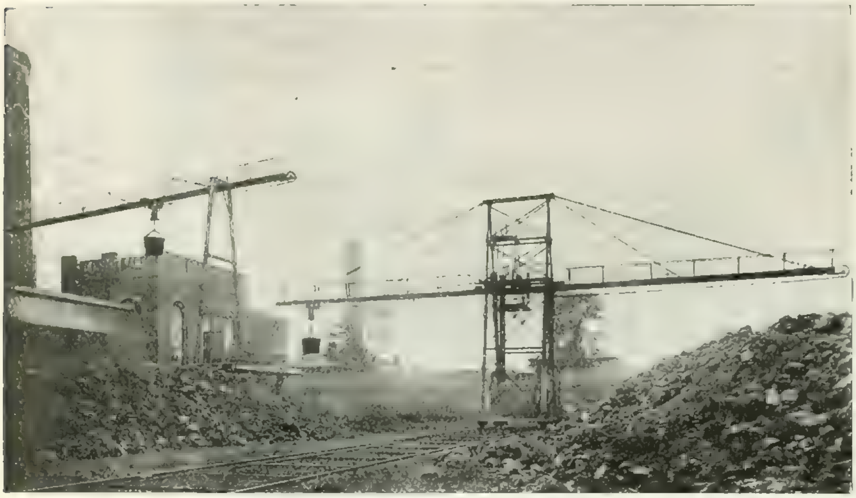

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For Rapid and Economical Handling of General Cargo, Coal, Ore, &c.

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WHEN ORDERING NEW BOILERS OR PIPE LINES
SPECIFY
WINN'S RELIABLE BOILER MOUNTINGS
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PROTECTED BY LETTERS PATENT
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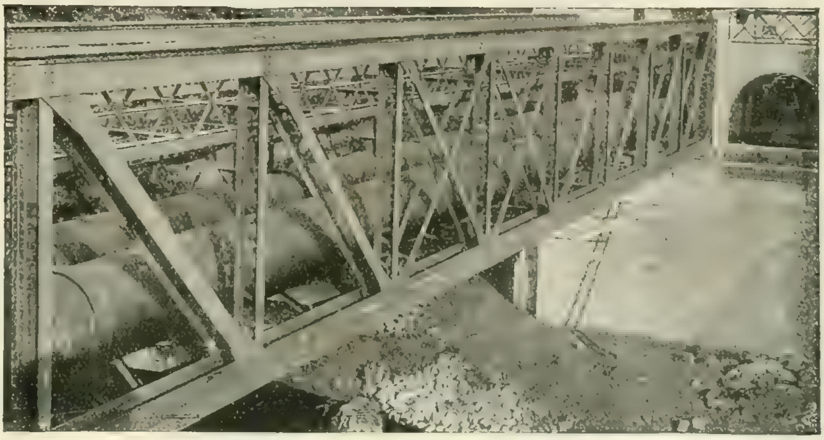

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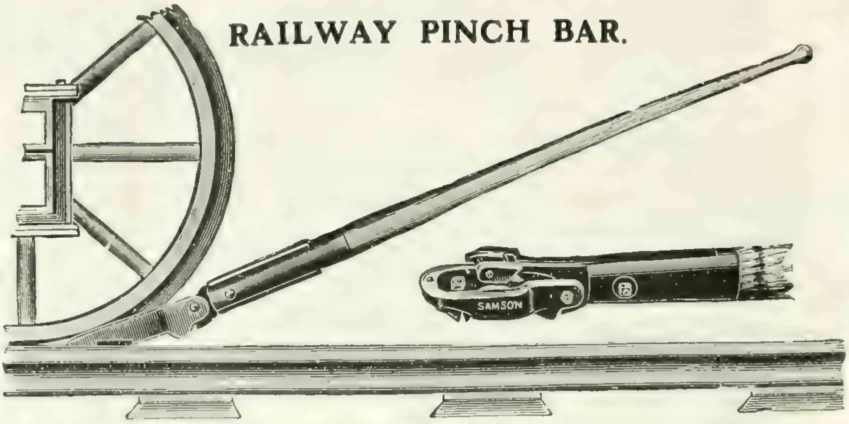
RAILWAY PINCH BAR.



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OUR OFFER:—

SPECIMEN BAR SENT ON SEVEN DAYS' FREE TRIAL CARRIAGE PAID BOTH WAYS.

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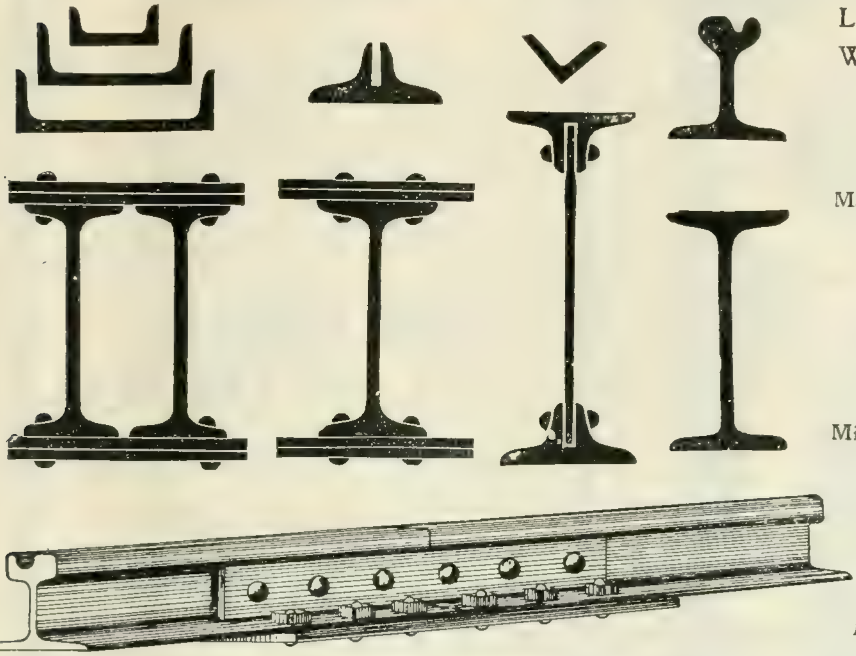

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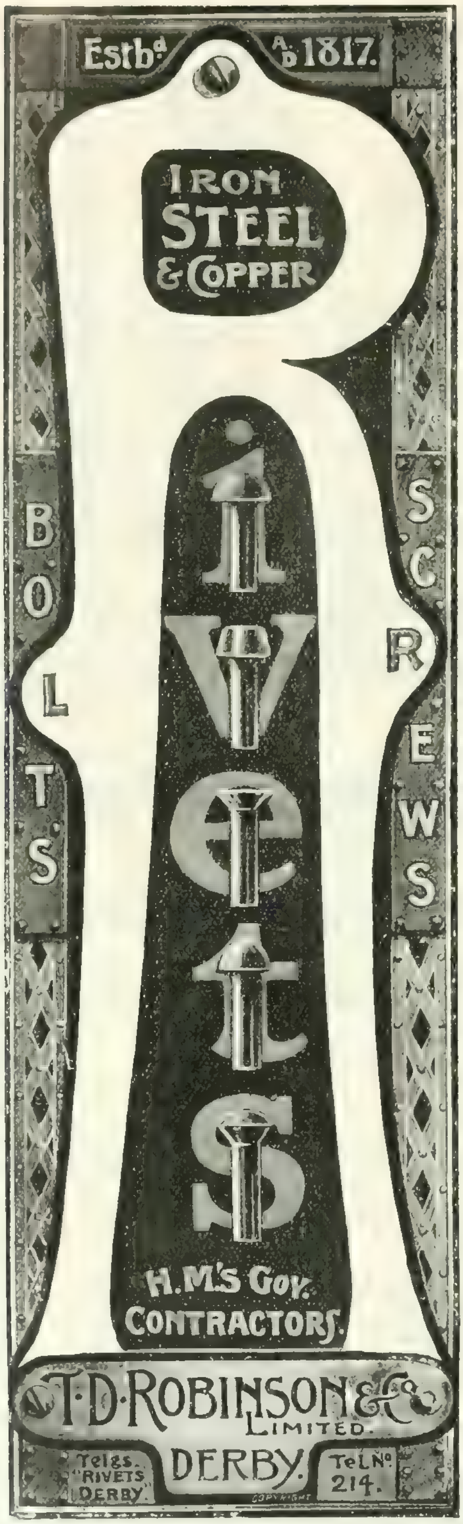

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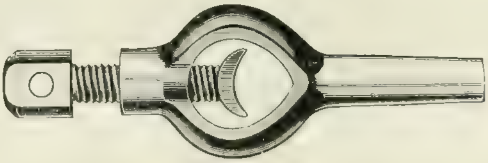

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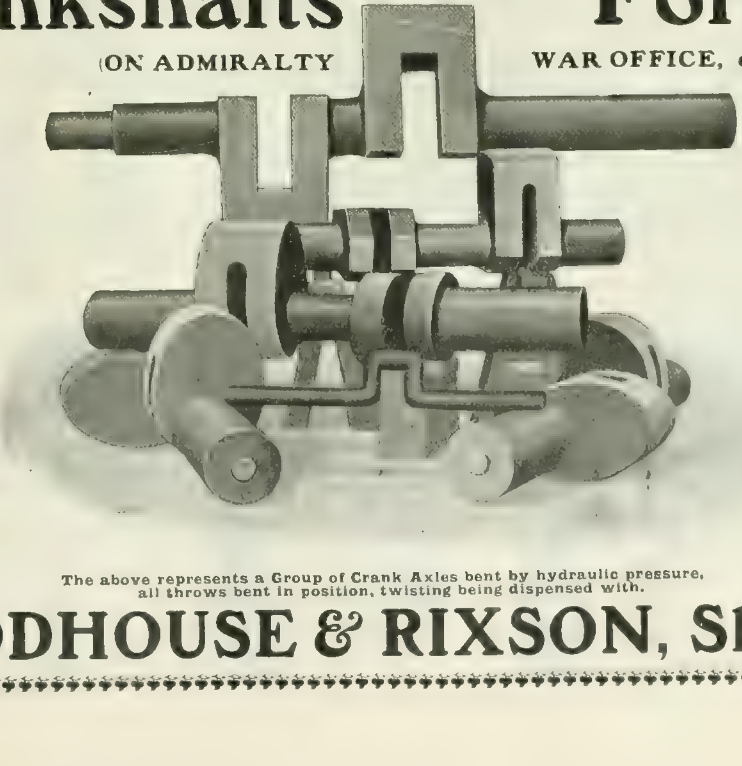

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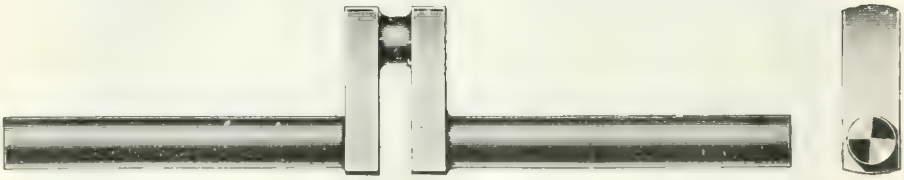

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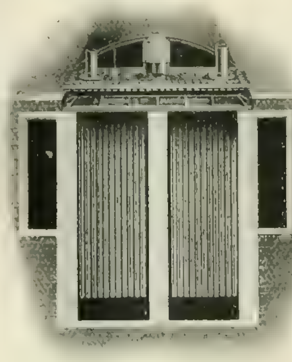

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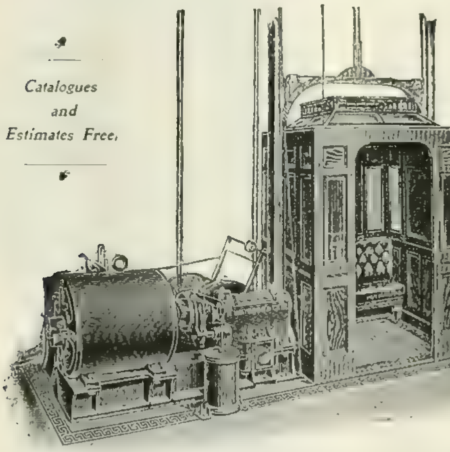

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Can save at least 5% ON THEIR WAGES BILL, and thousands of employers do so by the use of the

"Dey" Time Registers

which are automatic machines for registering the hour and minute at which Employees start and finish work,

and, with the New Attachment provides, in addition to the weekly time and wages sheets, the CARD SYSTEM for COST KEEPING.

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They are of British Manufacture Throughout.

They are absolutely the best Time Recorders in the World.

They are the cheapest up-to-date machine on the market.

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THEY COMPEL PUNCTUALITY.

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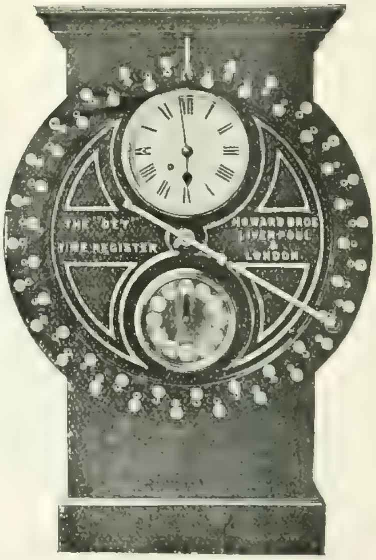

Full particulars from the Patentees and Manufacturers :—

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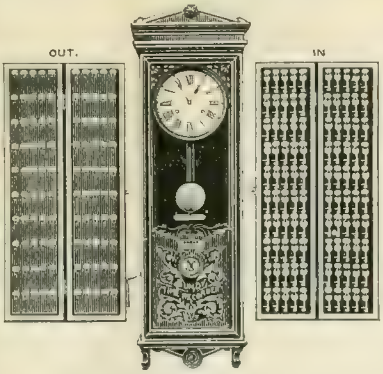

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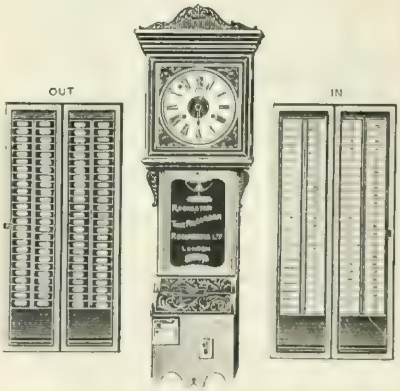

The "Rochester" Card Recorder.

TWO WAYS OF DOING IT.

¶ You can waste your money by issuing a Catalogue, which, being a cheap and unattractive production, is thrown on one side as soon as received, and thought no more about.

¶ It is just as easy to obtain a production worthy of yourself and of the trade to which you belong — something which will arrest attention — something unique in its way, and certain to be preserved. Which pays best ?

Southwood, Smith & Co. Ltd.
Printing Experts & Specialists,
PLOUGH COURT,
FETTER LANE, E.C.

PAGE'S WEEKLY Systems for Engineers

The

FISHER

BILLING

MACHINE

and

BOOK

TYPEWRITER

This illustration shows 13 Records of differently printed forms, varying in size, taking in every transaction, from the order with its various departmental copies to the invoice and wagon label.

ELLIOTT-FISHER CO.,

Office System Department,

85, Gracechurch Street, LONDON, E.C.,
and at 151, Hope Street, GLASGOW, and
94, Market Street, MANCHESTER.

Telephone:
4480 Avenue.

FILL IN AND CUT THIS OUT.

Are you making Invoices with Pen ?......... .... Pencil ? or Typewriter ?
Do you Press-copy same ?.......................... or take Carbon copy? or use Manifold Books ?
or make separate entry in Sales or Day-book ?

Do you manufacture and ship from original order as received? , or do you copy the order for your shipping and other departments ?...

Is it desirable or necessary for you to make more than one copy of your orders ?
If so, how many ?

Name
Business
Date 1905. Address

PAGE'S WEEKLY Engineers' Appliances.

Some "Swan" Points.

WHICH WOULD SUIT YOU?

For a Bold Hand - - -	use a Broad Point, say a "J" Swan.
For an Easy Running Hand -	,, Turned-up "Swan."
For Book-keeping - - -	,, Short Medium Point "Swan."
For Shorthand - - - -	,, Long Fine Point "Swan."

EVERY STEEL NIB CAN BE SUCCESSFULY MATCHED IN A "SWAN" FOR EVERY HAND AND EVERY WORK.

Prices from 10s. 6d., 16s. 6d., 25s., up to £20, post free.

Of all Stationers and Jewellers. *Write for New Catalogue, post free.*

MABIE, TODD, & BARD, 79 & 80, High Holborn, W.C., 93, Cheapside, E.C., 95a, Regent St., W., London;
3, Exchange Street, Manchester; and Brentano's, 37, Ave. de l'Opera, Paris

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Since our Advertisement appeared in PAGE'S WEEKLY, we have supplied over

9,000 BINDERS

To Engineering Firms, Shipbuilders, and Manufacturers

Instantly attached Instantly released Saving time and worry

To see a sample is to send an order.

A SAMPLE SENT FREE ON REQUEST.

THE TITAN BINDER COMPANY,
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IMPROVED
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Numbering
Machine

STEEL WHEELS

Inexpensive
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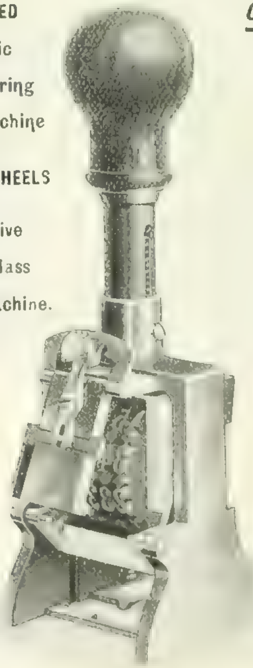

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& Stencil Plates
ENGINEERS' INSTRUCTION and NAME PLATES.

RUBBER STAMPS SPECIALLY MOUNTED With Sponge Rubber Seat in

THE RUBBER STAMP COMPANY,
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NO ONE CAN AFFORD

in these days of severe competition when "office expense" as well as factory cost needs careful watching,

TO IGNORE

the present-day methods used by the most progressive and successful concerns.

THE TIME & MONEY

saved in one year amply repays the first "investment," which can never be reckoned an "expense," for

PERPETUAL SYSTEMS

are practically "gilt-edged securities," and their use has always been extended after a fair practical trial.

FOR FULL PARTICULARS WRITE ON YOUR BUSINESS HEADING TO P.D.L. DEPT.

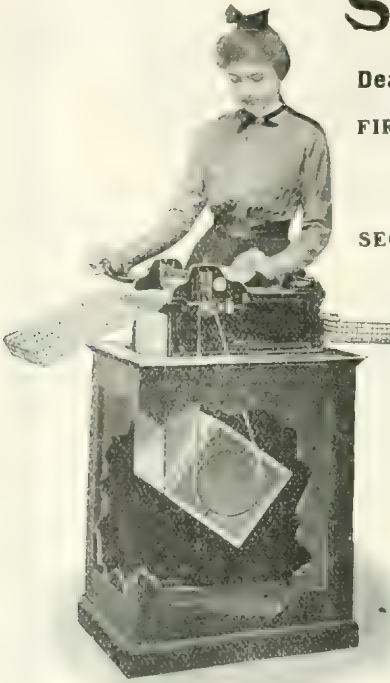
THE TRADING & MANUFACTURING CO., Limited,

TEMPLE BAR HOUSE,
FLEET STREET,
LONDON, E.C.

Telegrams: "DEVISERS, LONDON."

PAGE'S WEEKLY Systems for Engineers

SHANNON SYSTEMS



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Dealing with Correspondence.

FIRST: Copy your letters, agreements, and other outgoing correspondence on the **Shannon Letter Copier**, which copies ten times as quickly as an ordinary screw press.

SECOND: File the copies of answers with the original letters received in a **Shannon Letter Filing Cabinet**, in alphabetical and chronological order.

THE RESULT:

Perfect Copies. Instant reference to outgoing and incoming correspondence. Great saving of time, worry, and hard cash.

Shannon Letter Filing Cabinet.

Write for our Booklet No. 20, which deals exhaustively with this modern system.

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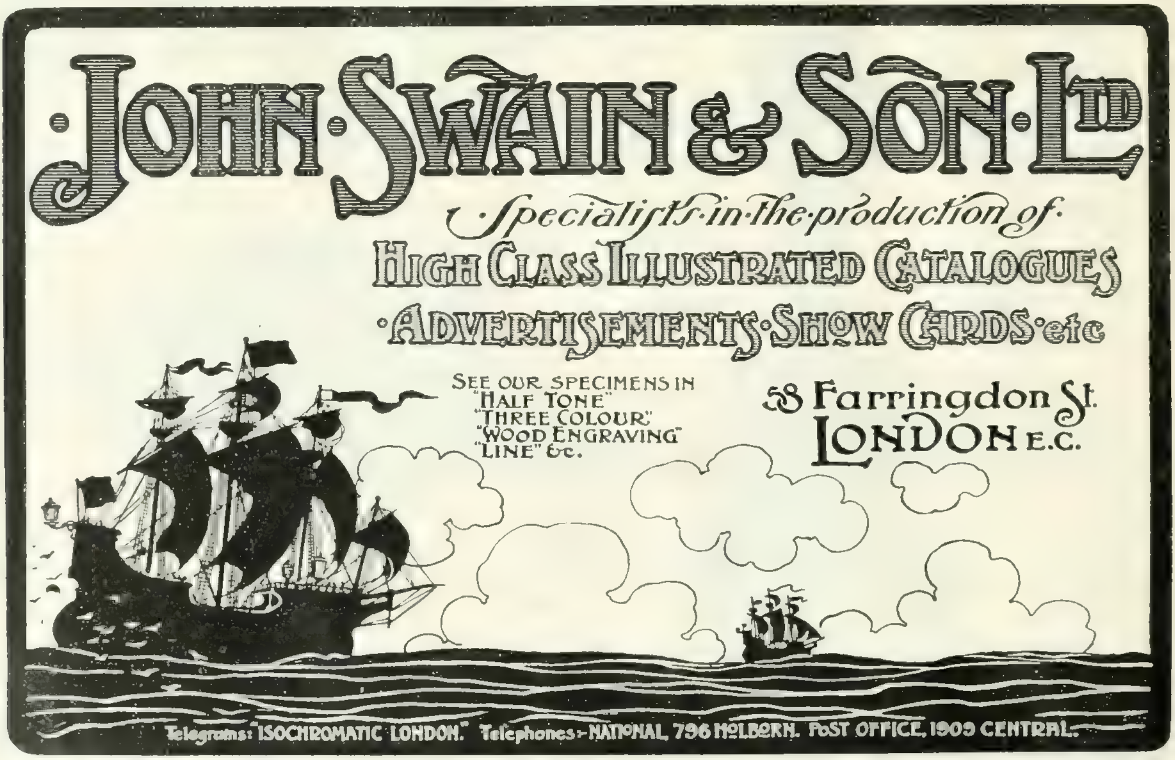
Head Offices and Showrooms: **Ropemaker St., LONDON, E.C.**
West End Branch: **Denman House, 20, Piccadilly, W.**
F. W. SCHAFER, Managing Director.



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DON'T HESITATE,

BUT INSTRUCT YOUR STATIONER TO SUPPLY

"BEDFORD BOND"

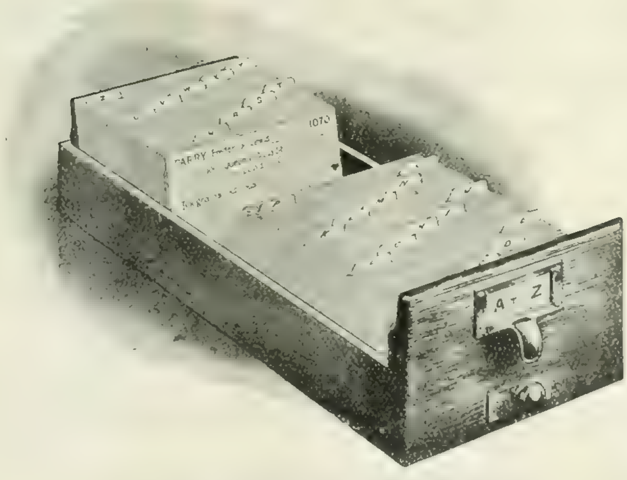
Every Sheet bears this Watermark, ☞

Manufactured in White and Five Tints.
Specially adapted for Departmental Stationery.

SUPERFINE TYPEWRITING PAPER.

A Single Idea with Vast Possibilities

Have you seen what a Card Index can do?



If you have not, we will be glad to show you.

THE LYLE COMPANY, LIMITED,
HARRISON STREET, GRAY'S INN ROAD,
LONDON, W.C.

PAGE'S WEEKLY Railways

NORTHERN RAILWAY OF FRANCE

AND

SOUTH EASTERN & CHATHAM RAILWAYS.

FREQUENT and RAPID COMMUNICATION BETWEEN LONDON and PARIS.

SHORTEST SEA PASSAGE

(ONLY ABOUT SIXTY MINUTES).

FIVE QUICK SERVICES DAILY, as under :—

Via DOVER AND CALAIS.

Depart from London.		Arrival in Paris	Depart. from Paris.		Arrival in London
†* [illegible] a.m.	For PARIS only	4.45 p.m.	† 8.0 a.m.	For Intermediate Stations	4.55 p.m. Charing Cross Station.
(Charing Cross Station)	For Intermediate Stations	6.5 p.m.	†* 9.50 a.m.	For CALAIS only	
† 11[illegible] a.m.	from Victoria Station ...	6.45 p.m.	†* 11.35 a.m.	.. ..	[illegible].45 p.m. Victoria Station
‡ 9.0 p.m.	Charing Cross Station	5.50 a.m.	‡ 8.40 p.m.	... Intermediate Stations	5.40 a.m. Charing Cross Station.

Via FOLKESTONE AND BOULOGNE.

Depart from London.		Arrival in Paris.	Depart. from Paris.		Arrival in London.
‡ 10.0 a.m.	from Charing Cross Station ...	5.5 p.m.	‡ 8.30 a.m.	Intermediate Stations	3.45 p.m. Charing Cross Station
†* 2.20 p.m.		9.15 p.m.	‡ 2.40 p.m.		10.45 p.m.
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† 1st and 2nd Class only. ‡ 1st, 2nd, and 3rd Class. * Restaurant Car between Paris and Calais or Boulogne, and *vice versâ*.

⁂ First-class Hotel and Restaurant at the Gare du Nord, Paris, and at Calais Maritime Station. Luncheon Baskets obtained at fixed prices.

The 2.20 p.m. departure from Charing Cross is the fastest connection between London and Bâle for Switzerland and Italy, *viâ* the Gothard Route. Through Corridor Trains and Restaurant and Sleeping Cars.

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LONDON-PARIS IN LESS THAN SEVEN HOURS.

Five Services Daily in Each Direction.

NEW EXPRESS AFTERNOON DINING CAR SERVICE

Daily (Sundays included), *via* FOLKESTONE and BOULOGNE

	P.M.		P.M.
CHARING CROSS - - - - - - - - - -	2.20	PARIS - - - - - - - - - - -	4.0
PARIS - - - - - - - - - - - -	9.15	CHARING CROSS - - - - - - - -	10.45

Mail Route *via* Dover and Ostend.

Three Express Services Daily in Each Direction.

Flushing Royal Mail Route to Germany, etc.

Two Services Daily in Each Direction.

For Full Particulars see S.E. & C.R. Continental Time Tables, price 3d. VINCENT W. HILL, *General Manager.*

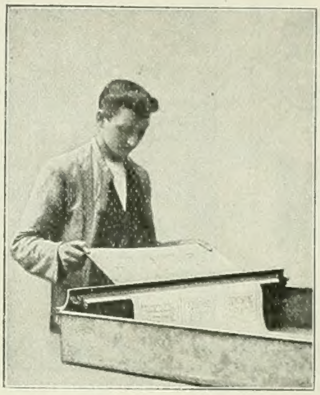
J. HALDEN & CO.

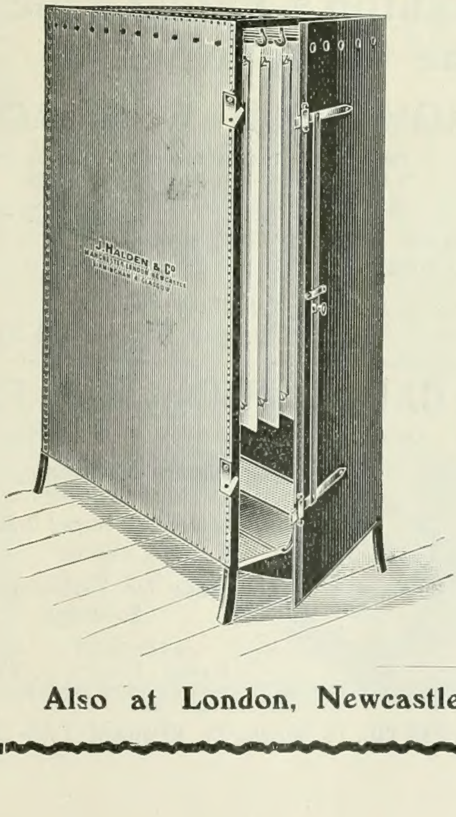
8, ALBERT SQUARE, MANCHESTER.

Two New and Invaluable Inventions for the Photo-Copying Department.

HALDEN'S PATENT . . .
PHOTO-PRINT SQUEEGEE

Facilitates Drying of Prints.
Promotes Cleanliness in Photo Room.
No Water Dripping on to Floor.
Quality and Finish Guaranteed.





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DRYING OVEN . .

Dries Six Prints in Six Minutes.
Heated by Gas or Steam.

Send for New Illustrated List of all Photo-Printing Apparatus and Materials, sent post free on request.

PHOTO LINENS.

A. 1. Black Line, Smooth and White.
D. 1. Ferro-prussiate, Pliant and White.

These highest grade fabrics are manufactured by J. HALDEN & CO., and guaranteed.

Sample Pieces for Testing post free on request.

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THE BEST BELT FOR EXPOSED SITUATIONS.

CONTRACTORS TO H.M. GOVERNMENT, FOREIGN GOVERNMENTS HOME & FOREIGN RAILWAYS.

INCORPORATING FIRMS ESTABLISHED OVER 100 YEARS.

FLEMING, BIRKBY & GOODALL, LTD.

HEAD WORKS & REGISTERED OFFICES,

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STANDARD OAK TANNED LEATHER BELTING.

13 INTERNATIONAL EXHIBITION AWARDS.

"GILBERT" WOOD SPLIT PULLEYS. PRINCIPAL AGENTS LARGE STOCK HELD.

SOLE MAKERS OF "TEON" BELTING, the Premier Heat, Steam, Water & Acid Proof Belt.

HYDRAULIC LEATHERS and all kinds of MILL & MECHANICAL LEATHERS.

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"SUPERIOR" HAIR BELTING.

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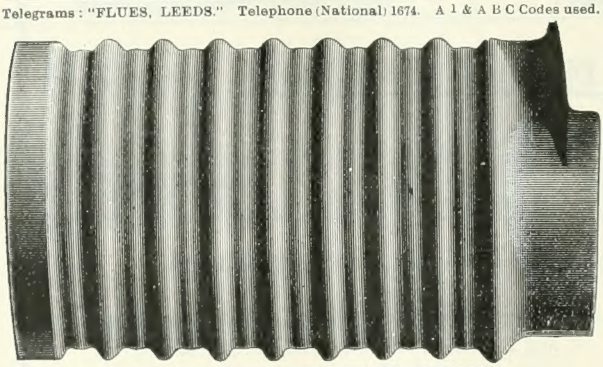
NOT AFFECTED BY STEAM, HEAT, OR COLD.

Telegrams: "FLUES, LEEDS." Telephone (National) 1674. A 1 & A B C Codes used.



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Deighton's Patent Flue & Tube Company, Ltd.

DEIGHTON'S FURNACE.

The Destructive Tests have proved the DEIGHTON FURNACE to be the strongest to resist collapse ever made.

It is also unequalled for Uniformity of Thickness and Easy Scaling.

MAKERS OF MARINE and LAND BOILER FURNACES.

Awarded 2 Bronze Medals, Paris Exhibition, 1900.

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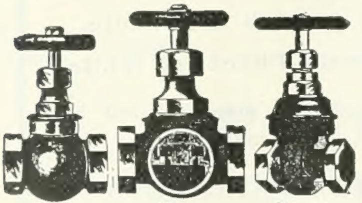
Pepper Road, LEEDS.**

BRITISH STEAM SPECIALTIES, LTD.,
LEICESTER, & 80, TURNMILL ST., LONDON, E.C.



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No. 1. Standard Globe Valve.

¾in.	1in.	1¼in.	1½in.	2in.
4/-	5/6	9/-	11/6	16/-

No. 2. Renewable Disc Globe Valve.

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VALVES ALL TYPES.

LIBERAL DISCOUNT

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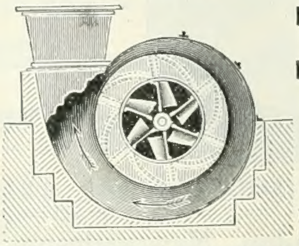
IN USE ON MINES ALL OVER THE WORLD.



Furnace Gas Cleaning Fans (In large use).

Induced & Forced Draught Fans.

Fans for Ventilation of Buildings.

ADVANTAGES:—
Highest Economy in Power.
Small Size of Fans.

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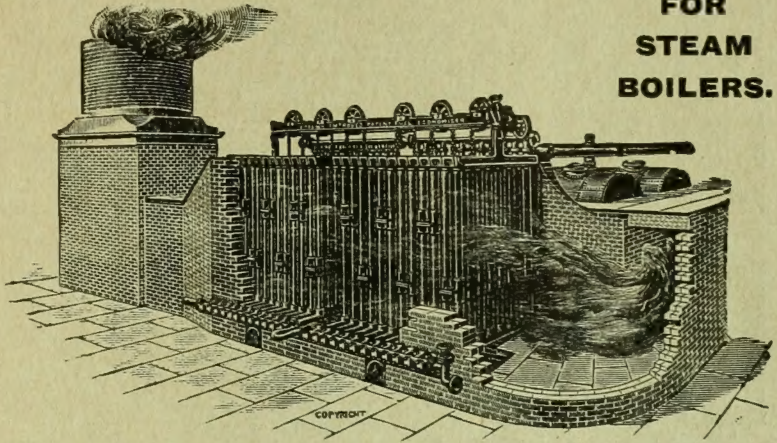
GREEN'S ECONOMISER

Saves 15 to 25 per cent. in Coal.

MAKES EASY WORKING IN THE BOILER HOUSE.

FOR STEAM BOILERS.



More Steam and higher efficiency at less cost. Large reserve of feed water at evaporative point always ready on sudden demand for extra power.

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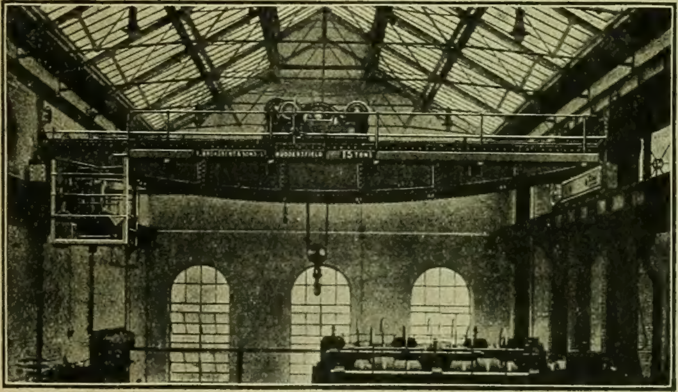

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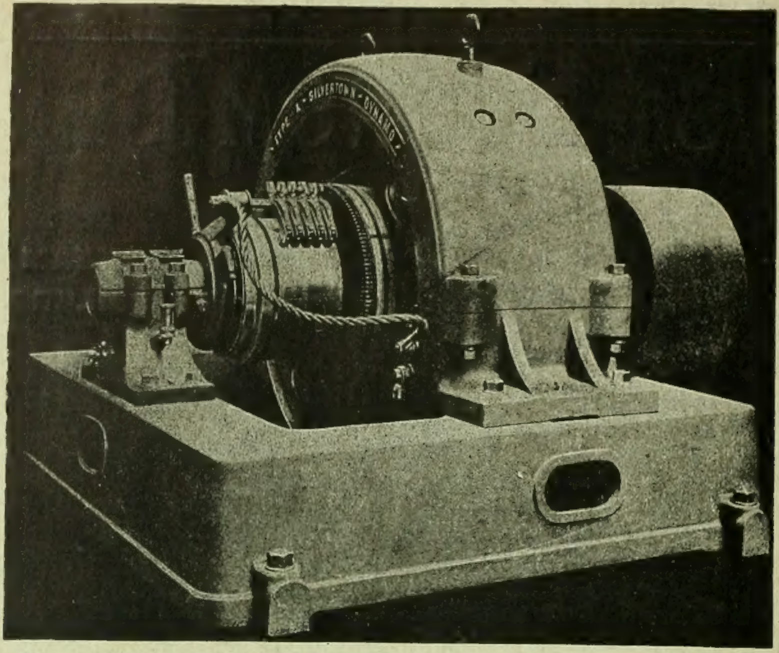

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General Steel Manufacturers, and SPECIALISTS in . . TOOL STEELS

Invite attention to their Unrivalled Self-hardening Steel.

FAIRLEY'S SELF-HARDENING TOOL STEEL

FOR HEAVY CUTS AT HIGH SPEEDS.

Is considered to be the HARDEST and TOUGHEST Steel yet made (although the cheapest in the Market). Small samples free to approved buyers.

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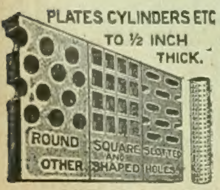

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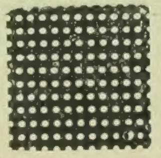

Perforated Metals, Wire Work, Gauze, Metallic Name Plates } Of all Descriptions.

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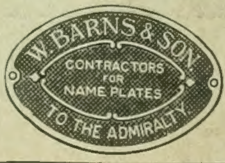

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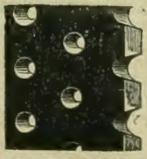

Wire Work of all kinds.

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